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A Dream Computer System!!
See page 17.

How Commodore Owners Use Their Computers

COMPUTE!'s GAZETTE

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November 1987
Issue 53, Vol. 5, No. 11
ISSN 0737-3716
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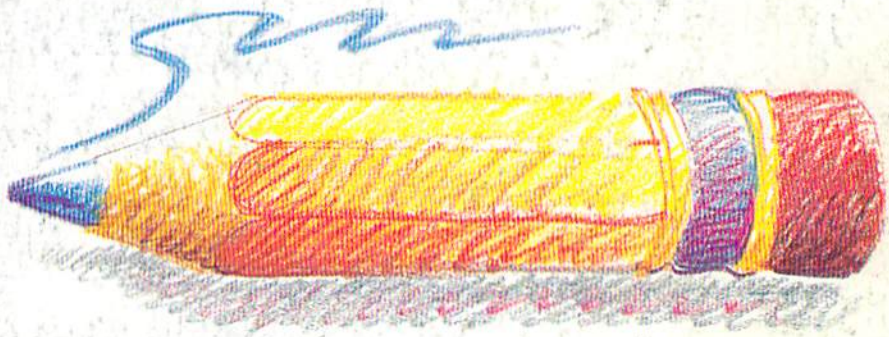
An invaluable programmer's tool. Create your own library of subprograms and call them from BASIC.



Sketch Pad

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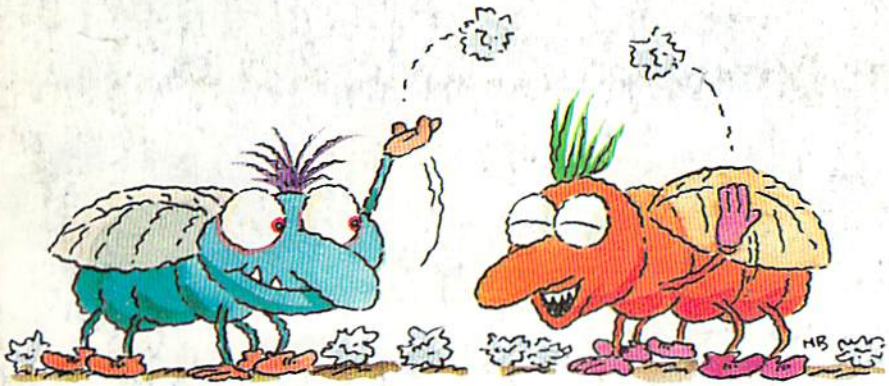

Barricade Buster

Complete control of the 128's 80-column screen.

Litterbug

A high-speed, arcade-action game for the 64.

Sprite Monitor

Search memory and capture sprites with this "snooper" utility for the 64.

Also In This Issue:

- Poster Printer
- Review: Lt. Kernal Hard Disk Drive
- SpeedScript 128 Date And Time Stamper
- And Much More

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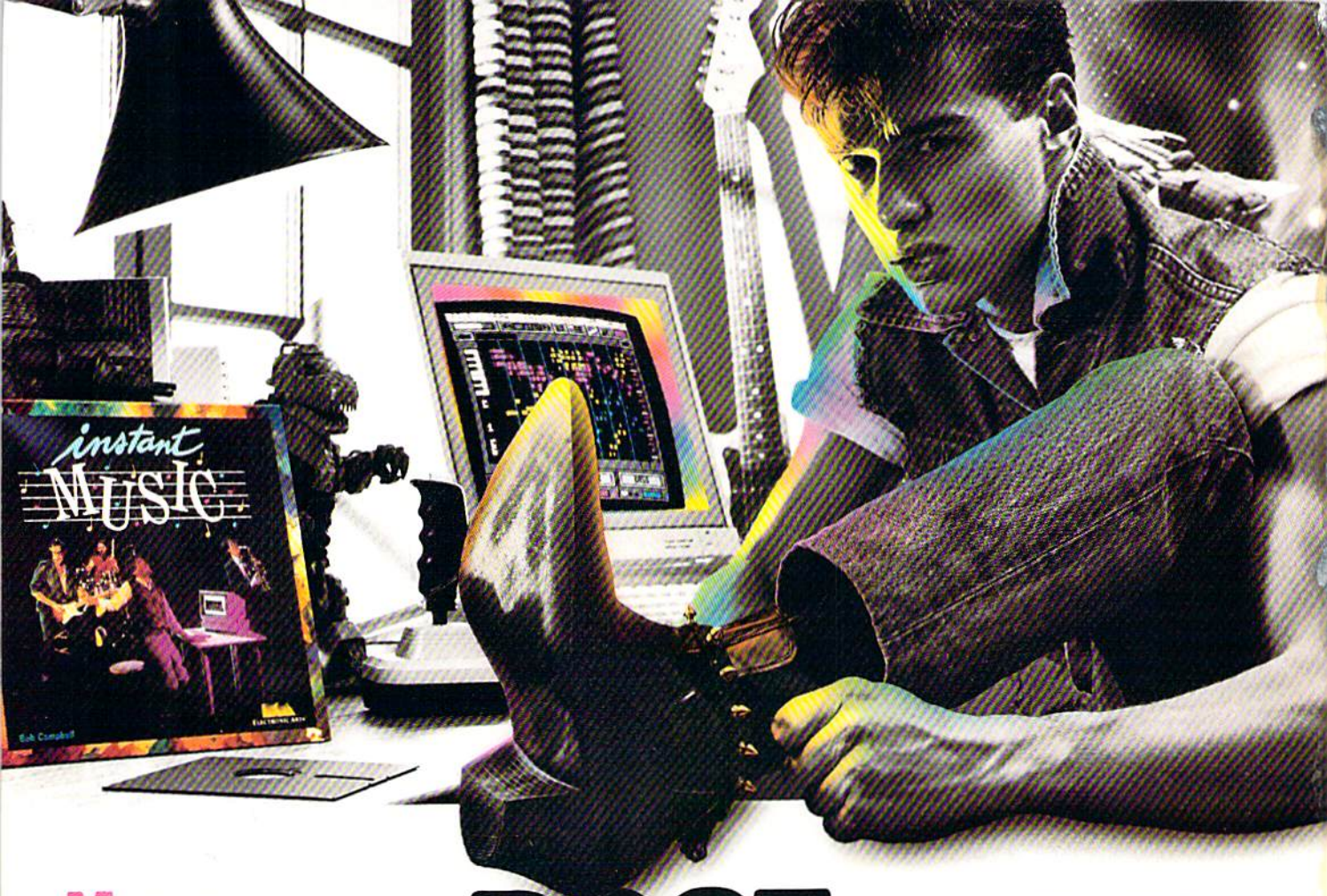

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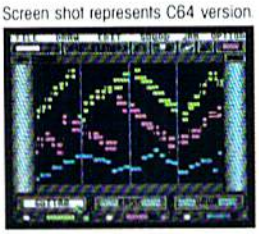
Screen shot represents C64 version.



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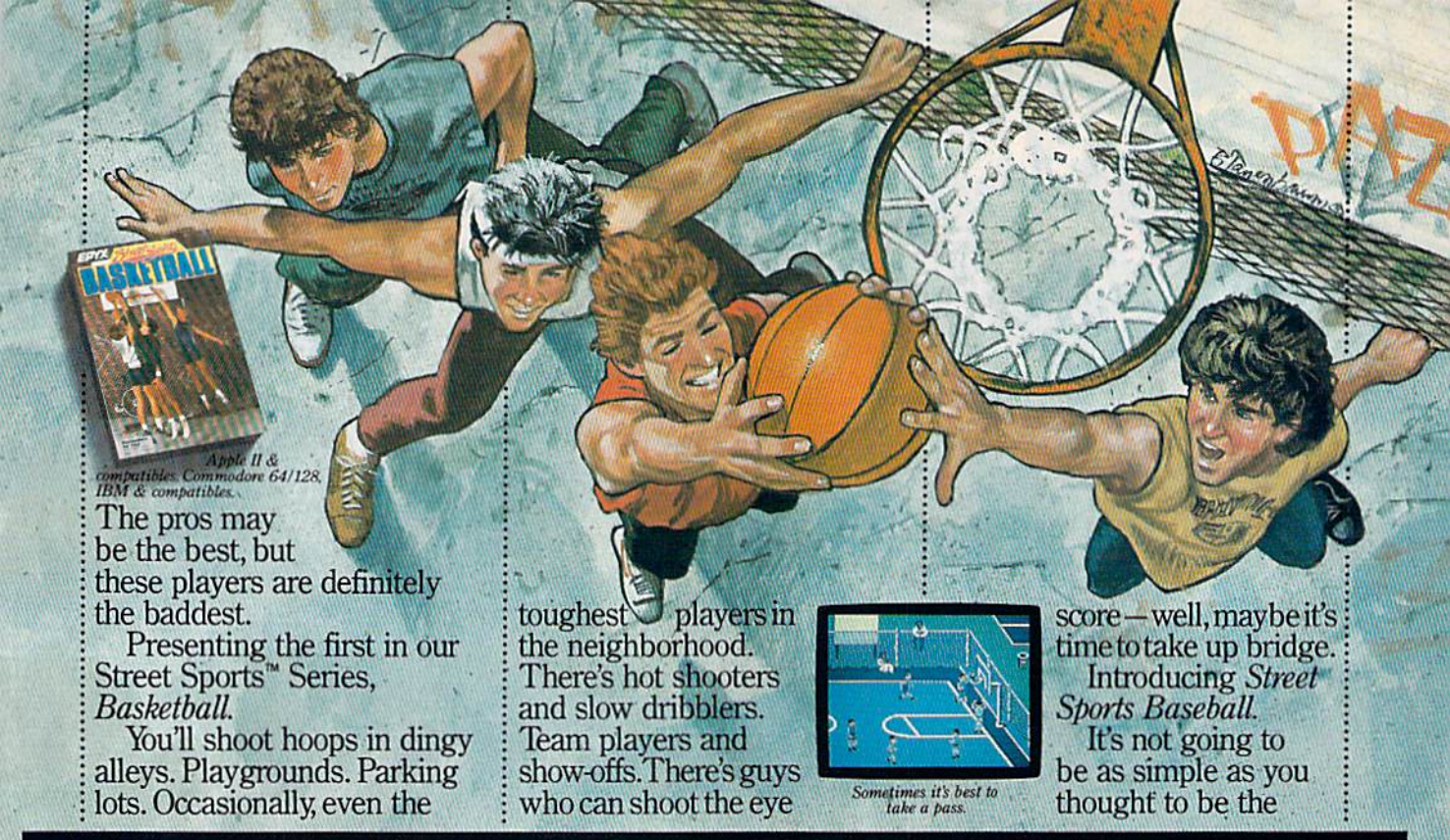

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It's not like any basketball game you've ever played on a computer. But just like every basketball game you've ever played for real.

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It's bottom of the ninth. Batter's 0 and 2. The score—well, maybe it's time to take up bridge.

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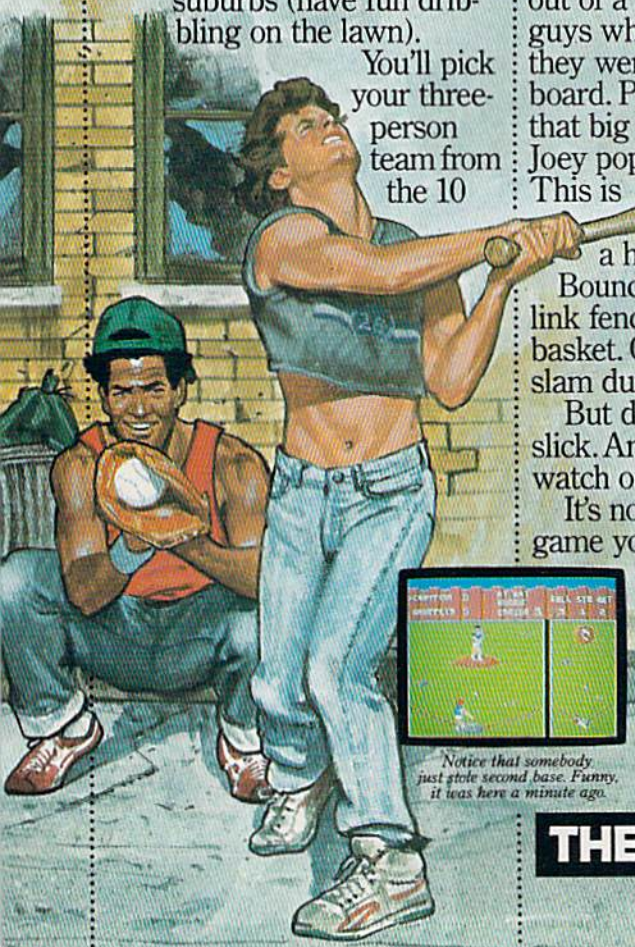
suburbs (have fun dribbling on the lawn).

You'll pick your three-person team from the 10



Notice that somebody just stole second base. Funny, it was here a minute ago.

THE STREET SPORTS SERIES

GAZETTE contents

November 1987 Vol. 5, No. 11

features

Computers at Work: Making Friends, Making Money, Making the Grade	*Keith Ferrell*	**20**	*

reviews

Lt. Kernal Hard Disk Drive	*Scott Thomas*	**30**	**128/64**
Jeremy Silman's Guide to Chess Openings* and *50 Classic Chess Games	*Selby Bateman*	**34**	**64**
Maniac Mansion	*Keith Ferrell*	**35**	**64**
Three Action Games for the 64	*Robert Bixby*	**36**	**64**

games

Litterbug	*Paul Choquette*	**44**	**64**
The Gumball Rally	*Louis R. Fernandez*	**48**	**128**

education/home applications

Sketch Pad	*Forrest Bentley*	**40**	**64**
Computing for Families: Holding a High-Tech Yard Sale	*Fred D'Ignazio*	**52**	*
Fraction Practice II	*David L. Pawlicki*	**56**	**128/64/+4/16**
Poster Printer	*John Robinson*	**62**	**128/64/+4/16**

programming

Subprograms for the 64	*James Tubbs*	**68**	**64**
***SpeedScript 128* Date and Time Stamper**	*Robert Kodadek*	**71**	**128**
Renumber	*Hubert Cross*	**72**	**64**
Sprite Monitor	*Harry Werner*	**73**	**64**
Barricade Buster: Accessing the 128's 80-Column Screen	*Robert Bixby*	**74**	**128**
Top Secret	*Gilles Breton*	**76**	**64/+4/16**
BASIC for Beginners: The MID$ Function	*Larry Cotton*	**78**	**128/64/+4/16**
Power BASIC: Crystal Clear	*Rhett Anderson and David Hensley, Jr.*	**81**	**64**

departments

The Editor's Notes	*Richard Mansfield*	**4**	*
Gazette Feedback	*Editors and Readers*	**10**	*
User Group Update	*Caroline D. Hanlon*	**69**	*
Horizons: The Beast with Two Brains	*Todd Heimarck*	**77**	**128**
Bug-Swatter: Modifications and Corrections		**80**	*
The *GEOS* Column: GeoPuzzle, Part 2	*Rhett Anderson and David Hensley, Jr.*	**82**	**64**

program listings

How to Type In COMPUTE!'s Gazette Programs	**118**	*
The Automatic Proofreader	**120**	**128/64**
MLX: Machine Language Entry Program for Commodore 64 and 128	**122**	**128/64**
Advertisers Index	**132**	*

*=General, **64**=Commodore 64, **+4**=Plus/4, **16**=Commodore 16, **128**=Commodore 128

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editor's notes

This month we're happy to present one of the best programs we've ever published, "Sketch Pad." Though the name is unassuming, don't let that fool you: It's probably the most versatile and feature-packed Commodore 64 drawing program ever published in a magazine. With it you can effortlessly create pictures in hi-res mode, and then save them to disk or print them on a Commodore 1526 or MPS-802 printer.

Not only does the program respond very quickly (you'll think you're painting with a real brush), it also includes many special options such as shape fill, automatic line drawing, rays, copy and paste, and text entry. In addition, you have a choice of six different brushes—and there's even an "undo" key for those times when your brush strokes aren't just the way you want them.

This month's main feature article is based on an idea we had several years ago when Commodore computers were just becoming widely popular: What do Commodore owners use their computers for? The answers we got ranged from organizing a bird-watching club to running various small businesses. This time, now that the Commodore 64 is the best-selling personal computer ever, our calls to subscribers yielded equally intriguing and inventive responses. One reader describes how he monitors far-flung gas plants from the comfort of his central offices. He keeps warm while his Commodores continually check on things at remote outposts. Others explain how they use their computers to open up the world to the handicapped, assist with a seafood business, monitor a chicken farm, and for a number of other valuable applications.

Also, in this issue, you'll find a variety of programs reflecting the varying interests of our readers. "Gumball Rally," a two-player game, expects you to be able to quickly make change if you want to win. "Litterbug" is an entertaining, arcade game in which fast reflexes are a must. For children, "Fraction Practice II" patiently teaches the sometimes-perplexing methods of multiplying and dividing fractions.

Applications include a time and date stamper for *SpeedScript 128* files; a versatile printer program which can create posters, banners, or greeting cards; and "Top Secret," a program that encodes other programs in order to hide your private information from prying eyes. Programmers will enjoy "Subprograms for the 64," a handy utility that allows BASIC programs to call canned subroutines from a disk drive, but without affecting variables. You can view memory (hi-res or multicolor) as sprites, and even capture sprites from other programs with "Sprite Monitor." And "Barricade Buster" is a tutorial which demonstrates how to access the 80-column screen on the Commodore 128. It also includes a sample game which illustrates exactly how to use the techniques described.

Every program and article is carefully tested and edited by the talented COMPUTE! Publications staff. Over the years, we have, of course, published our share of bugs. Our corrections column, "Bug-Swatter," has reduced in size, but we've never reached the goal of eliminating it altogether. Nonetheless, our efforts to bring you the best possible programs, features, and tutorials have paid off—COMPUTE! magazines are consistently the leading publications in home, educational, and recreational computing.

Recently, two new assistant editors joined the COMPUTE! and GAZETTE staffs, to help Editor Lance Elko maintain the quality of our flagship publications. Clif Karnes earned a master's degree in music theory. He taught Medieval and Renaissance music, conducted a wind ensemble, and wrote freelance for several years. Like so many of us, Clif started exploring computers when they became commerically available—and was hooked. Several years ago he bought a 64 and began programming in BASIC. Since then, he's learned C, Pascal, and machine language; bought an IBM PC XT and a 128; and developed a passion for telecommunications.

Randy Thompson worked as a freelance programmer and was published in several computer magazines. He also did contract work for *Home Computer Magazine*, translating programs written for the TI, Apple, and IBM PC to run on the 64. That magazine eventually hired him as technical editor. In addition, he was involved in the launch of *Music and Electronics* magazine. He is author of *TEX-SEQ*, the only MIDI music sequencer commercially available for the TI-99/4A computer. Randy's other interests include building electronic gadgets and playing guitar. He owns a Commodore 64 and an Amiga.

Richard Mansfield
Editorial Director

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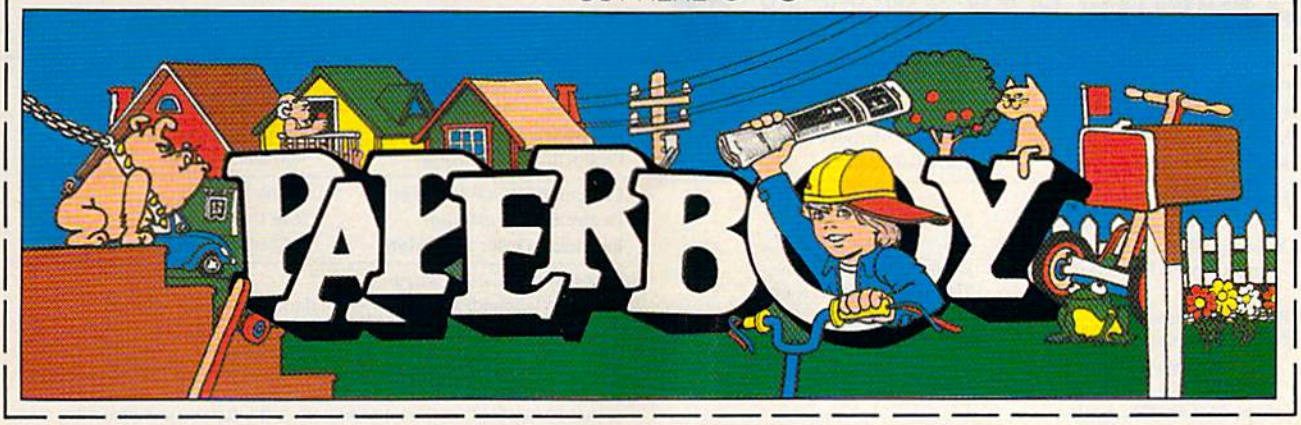

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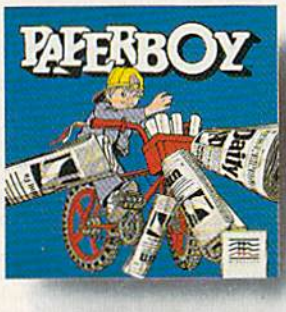

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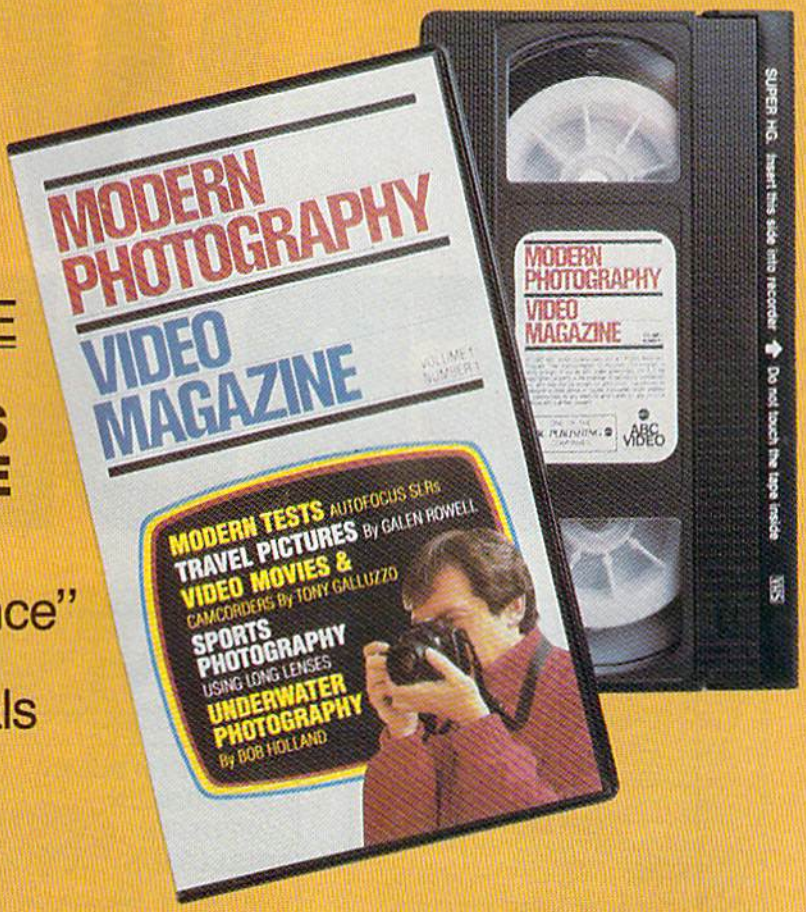

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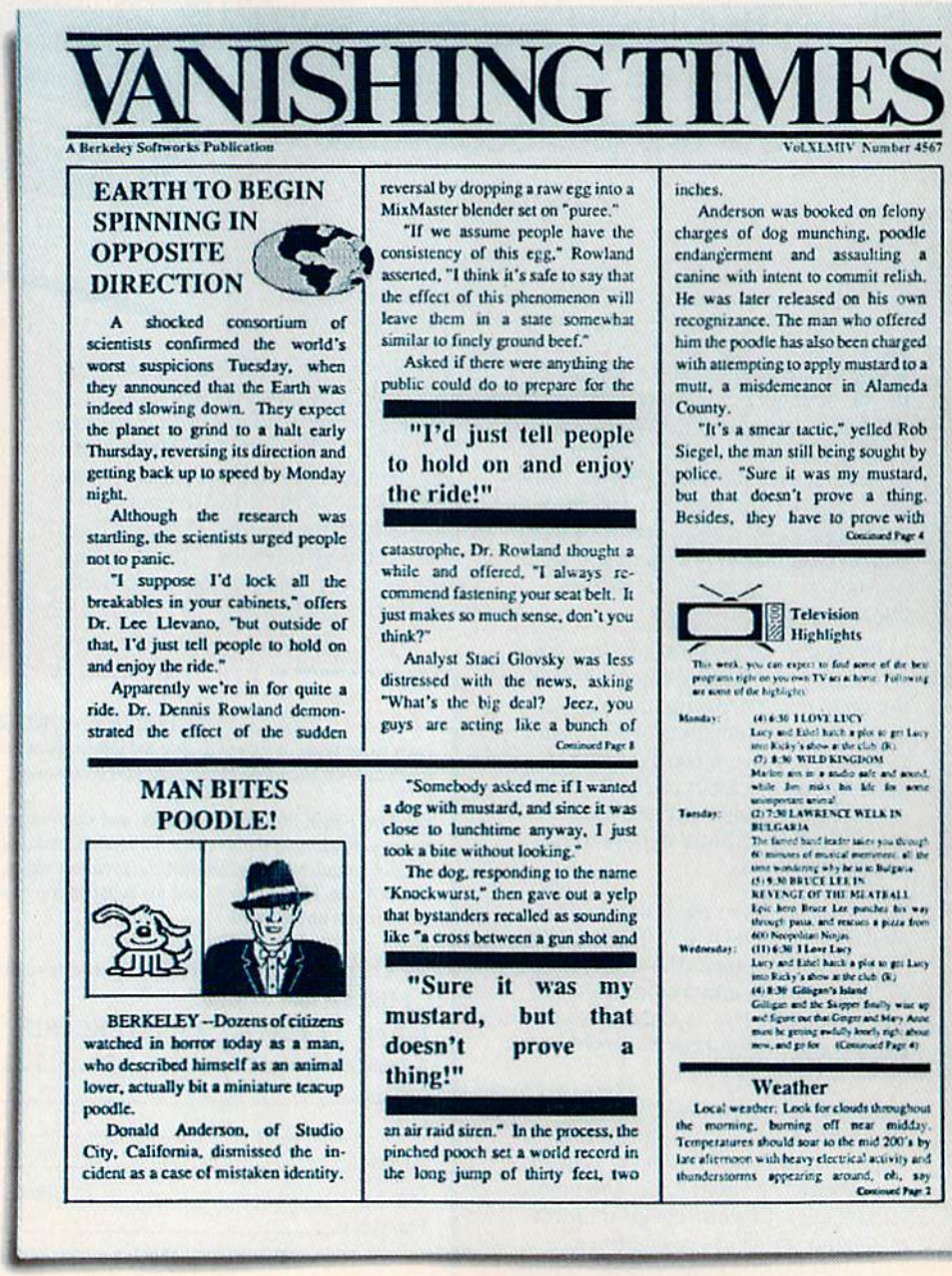
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EARTH TO BEGIN SPINNING IN OPPOSITE DIRECTION

A shocked consortium of scientists confirmed the world's worst suspicions Tuesday, when they announced that the Earth was indeed slowing down. They expect the planet to grind to a halt early Thursday, reversing its direction and getting back up to speed by Monday night.

Although the research was startling, the scientists urged people not to panic.

"I suppose I'd lock all the breakables in your cabinets," offers Dr. Lee Llevano, "but outside of that, I'd just tell people to hold on and enjoy the ride."

Apparently we're in for quite a ride. Dr. Dennis Rowland demonstrated the effect of the sudden reversal by dropping a raw egg into a MixMaster blender set on "puree."

"If we assume people have the consistency of this egg," Rowland asserted, "I think it's safe to say that the effect of this phenomenon will leave them in a state somewhat similar to finely ground beef."

Asked if there were anything the public could do to prepare for the catastrophe, Dr. Rowland thought a while and offered, "I always recommend fastening your seat belt. It just makes so much sense, don't you think?"

"I'd just tell people to hold on and enjoy the ride!"

Analyst Staci Glovsky was less distressed with the news, asking "What's the big deal? Jeez, you guys are acting like a bunch of

Continued Page 8

MAN BITES POODLE!

BERKELEY --Dozens of citizens watched in horror today as a man, who described himself as an animal lover, actually bit a miniature teacup poodle.

Donald Anderson, of Studio City, California, dismissed the incident as a case of mistaken identity.

"Somebody asked me if I wanted a dog with mustard, and since it was close to lunchtime anyway, I just took a bite without looking."

The dog, responding to the name "Knockwurst," then gave out a yelp that bystanders recalled as sounding like "a cross between a gun shot and an air raid siren." In the process, the pinched pooch set a world record in the long jump of thirty feet, two inches.

"Sure it was my mustard, but that doesn't prove a thing!"

Anderson was booked on felony charges of dog munching, poodle endangerment and assaulting a canine with intent to commit relish. He was later released on his own recognizance. The man who offered him the poodle has also been charged with attempting to apply mustard to a mutt, a misdemeanor in Alameda County.

"It's a smear tactic," yelled Rob Siegel, the man still being sought by police. "Sure it was my mustard, but that doesn't prove a thing. Besides, they have to prove with

Continued Page 4

Television Highlights

This week, you can expect to find some of the best programs right on you own TV set at home. Following are some of the highlights:

Monday: (4) 6:30 I LOVE LUCY
Lucy and Ethel hatch a plot to get Lucy into Ricky's show at the club (R).
(7) 8:30 WILD KINGDOM
Marlon sets up a studio safe and sound, while Jim risks his life for some unimportant animal.

Tuesday: (2) 7:30 LAWRENCE WELK IN BULGARIA
The famed band leader takes you through 60 minutes of musical merriment, all the time wondering why he is in Bulgaria.
(5) 9:30 BRUCE LEE IN REVENGE OF THE MEATBALL
Epic hero Bruce Lee punches his way through pasta, and rescues a pizza from 600 Neopolitan Ninjas.

Wednesday: (11) 6:30 I Love Lucy
Lucy and Ethel hatch a plot to get Lucy into Ricky's show at the club (R).
(4) 8:30 Gilligan's Island
Gilligan and the Skipper finally wise up and figure out that Ginger and Mary Anne must be getting awfully lonely right about now, and go for (Continued Page 4)

Weather

Local weather: Look for clouds throughout the morning, burning off near midday. Temperatures should soar to the mid 200's by late afternoon with heavy electrical activity and thunderstorms appearing around, oh, say

Continued Page 2

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T MADE GE NEWS.

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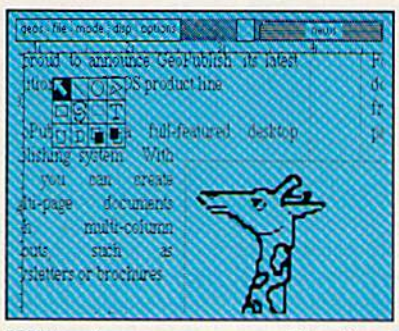

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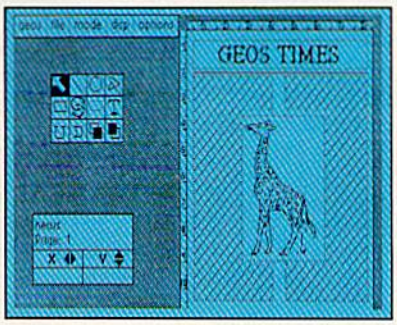

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Do you have a question or a problem? Have you discovered something that could help other Commodore users? We want to hear from you. Write to Gazette Feedback, COMPUTE!'s Gazette, P.O. Box 5406, Greensboro, NC 27403. We regret that due to the volume of mail received, we cannot respond individually to programming questions.

Where Did Amiga Go?

In 1984, I purchased a joystick called The Power-Stick by Amiga. Its small size and durability have made it my favorite. I would like to purchase more of them but I can't find any. Do you have any information where I could find one?

Robert Argetsinger

During the videogame boom several years ago, many employees of Atari left to start their own businesses. Among these are Activision and Imagic. Another of these videogame startups was a small company called Amiga. After designing the Atari 2600 videogame system and Atari 800 computer, Jay Miner of Amiga wanted to design the next-generation videogame machine based on the powerful 68000 chip. To bankroll development of the machine (which was code named "Lorraine"), Amiga designed and sold The Power-Stick joystick. As the market changed, the Amiga game machine became a computer, and joystick production was halted. The company was eventually bought by Commodore and the computer was introduced as the Commodore Amiga 1000. Although the joysticks are highly regarded, they are indeed rare.

Calculated GOTO For The 128

In September 1986 you published the following calculated GOTO routine for the 64.

```
60 LN=500:REM LINE NUMBER
61 POKE 785,188:POKE 786,168
62 POKE LN,PEEK(LN)
63 LN=USR(LN)
64 END
500 PRINT "LINE 500"
```

Could you adapt it to run on the Commodore 128 in 128 mode?

Jeff Murphy

The program above works also on the 128 with the exception of one line. Substitute the following line, and you'll have a working routine:

```
61 POKE 4633,251:POKE 4634,89
```

The 128's GOTO routine is found at a different location, as is the USR vector.

Screen Collisions?

I have heard of collision detection for sprites. Is there something like that for screen graphics? If yes, please tell me how to do it.

Kingston Cassidy

When you PEEK the VIC-II register at 53278 and find a value other than zero, it means that two or more sprites have collided with each other. If several collisions are taking place, you can tell which sprites are involved, but you can't determine which sprites are hitting which other sprites.

The question you asked could be interpreted two ways. If you're interested in finding out when a sprite collides with a character or other foreground image on the hi-res screen, then the answer is yes. The register at 53279 tells you when sprites are colliding with graphics on the screen.

However, if you want to check for a collision between two characters, a bit of an explanation is in order. Characters and sprites have at least two colors. The foreground color is what you see and the background color is the transparent part. Sprites can slide smoothly over any area of the screen, so there's a possibility that part of a sprite will overlap part of another sprite or a screen character. This is called a collision. When a collision occurs, the VIC-II chip has to decide which foreground color to display (collisions always involve foreground colors, never background colors).

Strictly speaking, there's no such thing as a character-to-character collision. The text screen has 40 columns and 25 rows. Within each character cell, you'll find a single character that fits the cell exactly. Characters don't overlap, and if you POKE a new character to a certain location, the new character completely replaces the old one.

When you're moving a character around the screen using POKE, you can PEEK the new location before you POKE, to see which character already occupies that portion of screen memory. In a sense, this would be collision detection, but it would be handled by software (your program) instead of being a hardware register that's automatically updated by the VIC-II chip.

A Working Menu

I have owned a 64 for about three months. In trying my hand at programming for the first time, I came up with a simple program called "Shapes" for my three year old. I created a disk with programs just for her. Being just three, she has no idea how to load and run programs, so I thought I'd come up with a menu program from which she could load Shapes and other programs.

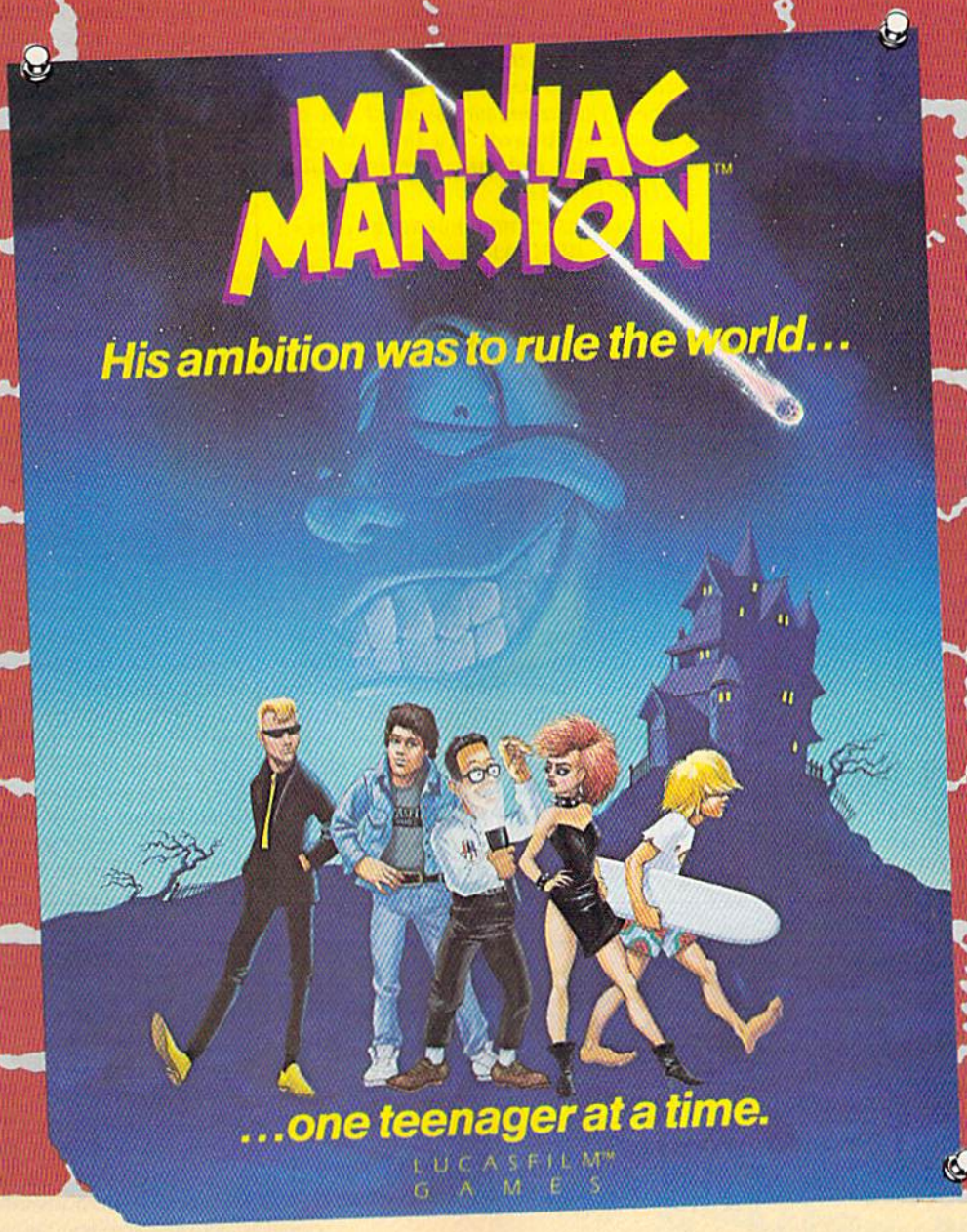
The menu program seems to run well until the Shapes program is loaded. After the first few lines run, I get an error in lines that don't even exist. Can you please explain what my program or my computer has done?

Gail Nelson

The LOAD command has two personalities and will act in two different ways depending on whether you use it in direct mode or from inside a program. If you type LOAD followed by the filename and the device number (LOAD "SHAPES",8, for example), the program loads into memory and you get the cursor back. At that point, you can LIST the program, change lines, RUN it, or whatever. An important side effect of a direct-mode LOAD is that all variables are cleared.

When you LOAD a program from inside a second program, a couple of the rules change. For one thing, the second program not only loads into memory, it also starts running. The line in your menu program that says RUN is unnecessary because the LOAD will both load and run the second program. The second new rule is that variables are not *cleared. Thus, it is possible to run a program, calculate some values or define some strings, and send the values to a second program as long as you execute the LOAD from within the first program. The technique of creating a series of programs that load and run each other, passing variables back and forth, is called* chaining.

Chaining works fine as long as the first program in the chain is longer than any subsequent program you may load. If the first program is shorter than a chained program (as your menu program is), you'll have trouble.



These guys got problems! *Jeff just wants to party. Bernard's flashlight batteries are going dead. Syd and Razor are just trying to start a band. Then on top of it all, Dave's girlfriend Sandy gets kidnapped, and she's being held captive by strange Dr. Fred!*

But wait! There's more! *Dave needs your help to rescue her. You pick two of Dave's friends to help him. Then you direct all three characters around the mansion, and gather the objects they'll need to save poor Sandy—not to mention themselves.*

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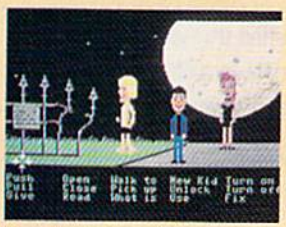

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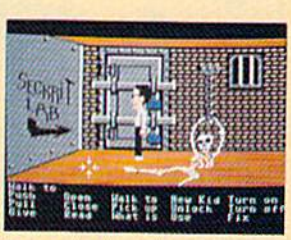

Could this be a clue? You decide.

If you can't find Maniac Mansion at your local retailer, call 1-800-227-6900 to order by mail.

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On the 64, programs load into memory at the start of BASIC, which is usually location 2049. Variables are stored immediately after the BASIC program. Let's say your menu program is 601 bytes long and it uses locations 2049–2649. Variables would start at 2650. Let's say the Shapes program (the second program) is 1000 bytes long and would thus occupy locations 2049–3048. When you load it from the menu program, the 64 wants to keep the variables intact, so it maintains the pointer that says variables can be found at 2650.

In this example, the second program ends at 3048, but the computer wants the variables to start at 2650, which sets the scene for disaster. The first time the second program uses a variable, the computer stores the value somewhere in the middle of the program, scrambling the program from that point forward.

There are two solutions to this problem. The first is to make the first program adjust the pointer to the start of variables. Load the longest program you'll be chaining—the one that uses the most disk blocks in the directory. After it's in memory, enter PRINT PEEK(45), PEEK(46) in direct mode. Write down the numbers. At the beginning of the menu program, before any variables are declared, add a line to POKE those values into locations 45 and 46. To be safe, you could add one to the number from location 46 before POKEing it.

If you don't need to preserve variable values, you can print the LOAD and RUN commands on the screen and force the computer to press RETURN over the lines. This technique is called the dynamic keyboard. *Try this example, which loads and runs a program called CHEESEBURGER.*

```
FB 500 A$="CHEESEBURGER":QT$=C
       HR$(34)
SB 510 PRINTCHR$(147);"LOAD";Q
       T$;A$;QT$;",8"
HC 520 PRINT:PRINT:PRINT:PRINT
       :PRINT"RUN"
CM 530 POKE631,19:POKE632,13:P
       OKE633,13:POKE198,3:END
```

The POKEs to the keyboard buffer at 631 are one CHR$(19), the HOME key, and two CHR$(13)s, the RETURN key. The POKE to 198 tells the 64 that three keys are waiting in the buffer. When the program ends, BASIC is fooled into thinking the user pressed HOME and two RETURNs. The screen already holds the lines that say LOAD and RUN, so those two lines execute. Since the second program is loaded from direct mode, you won't have the problems with variable pointers and scrambled programs.

Commodore 128 users will be pleased to learn that these gyrations are unnecessary when programming in 128 mode. Since the 128 keeps variables in a separate bank of memory from program text, there are no problems when one program chains in another. Hence, the techniques described above do not apply to the 128. If you want to pass variables from program to program, you would DLOAD"PROGRAM2". To run a second program without carrying over the variables, RUN "PROGRAM2".

A Prime Cut

I have enclosed a program for the 64 that searches for numbers that are perfect squares and perfect cubes. Could you suggest a similar program that would search out prime numbers? The only program I've seen uses DATA statements.

F.J. Cole

Squares and cubes follow a regular pattern, which means it's possible to write programs that search a range of numbers for any squares or cubes that might exist. A variety of formulas can check a number to see if it is the perfect square or cube of another number.

Prime numbers don't follow such a pattern. You can't use a formula to generate a list of primes.

There's a strategy you can use, however. Instead of searching for prime numbers, look for composite (non-prime) numbers. Whatever's left over will be a

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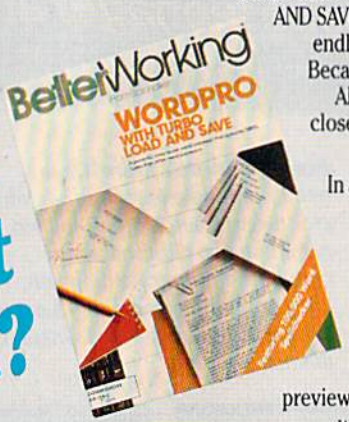

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prime. A Greek mathematician named Eratosthenes, who lived around 200 B.C., is credited with first inventing this idea.

The algorithm called the Sieve of Eratosthenes works this way: First, write down all the numbers from 2 to 50 (or any other upper limit). The number two isn't crossed out, so it must be a prime, but any multiple of two is a composite number, so you cross out every second number after two (4, 6, 8, 10, and so on). Next on the list is three, which isn't crossed out. Run through the list again, striking out every third number. Four is crossed out (because of two); skip over it. The next prime is five and you erase every fifth number. This process is dull and repetitive, but it works.

Fortunately, computers don't mind performing repetitive calculations. Here's a BASIC version of the Sieve. It finds all the primes between 2 and 1000.

```
JX 10 REM SIEVE
QJ 20 MAX=1000:DIMN%(MAX)
FC 30 M2=INT(MAX/2):D=2
JQ 40 FALSE=0:TRUE=-1
MS 50 PRINT"PRIME NUMBERS:"
HM 60 FORJ=DTOM2
MG 70 IF N%(J)THEN130
CC 80 PRINTJ;:IFPOS(1)>30THENP
      RINT
CP 90 LP=J*2
FC 100 FORK=LPTOMAXSTEPJ
XC 110 N%(K)=TRUE
JS 120 NEXTK
QS 130 NEXTJ
PC 140 FORJ=M2+1TOMAX
SD 150 IFN%(J)=FALSETHENPRINTJ
       ;:IFPOS(1)>30THENPRINT
CP 160 NEXT
```

Keeping Time

I have been searching for a BASIC program to read the time-of-day clock in the 128, but have been unable to locate one in any computer publications. TI$ just doesn't cut it in my application, which involves lots of printing and disk access. Can you help me?

Dave Harks

BASIC's clock, accessed using the reserved variables TI and TI$, is maintained by the computer's operating system software, not by hardware. A three-byte time value is incremented 60 times per second by the system's IRQ interrupt handling routine. (The timer bytes are locations 160–162 in the 128, 64, and VIC-20.) Because the clock is interrupt-driven, its accuracy is adversely affected by operations such as serial bus (disk and printer) and tape communications that change the IRQ handling sequence.

The 128 and 64 both have a more accurate timekeeping alternative. The two Complex Interface Adapter (CIA) chips in these computers each contain a time-of-day (TOD) clock. Since these clocks are driven by the frequency of the AC power line, they are not affected by any computer operations. And since the power line frequency is carefully controlled, these clocks should be quite accurate. Unfortunately, the computers' normal operating systems offer no support for setting or reading these clocks, so you must do your own programming. (The CP/M operating system for the 128 does use a TOD clock for timekeeping.)

For both computers, the clock in CIA 1 is read and set through locations 56328–56331 ($DC08–$DC0B). (On the 128, the system must be configured for bank 15.) These locations hold the tenths of seconds, seconds, minutes, and hours values of the current time. The values are in binary-coded decimal (BCD) format. That is, the high nybble (bits 4–7) of each location holds the tens digit of the corresponding value, and the low nybble (bits 0–3) holds the ones digit. For example, at 11 o'clock, the hours location would hold the value 17 ($11 in hexadecimal) rather than 11. The tenths-of-seconds location supplies a single digit in the low nybble; the high nybble is unused. Time is kept in standard 12-hour format. The high bit of the hours location provides an a.m./p.m. flag. You can interpret this bit however you want; the convention is to use 0 for a.m. and 1 for p.m.

For proper operation, the clock locations must be read or written in the cor-

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rect sequence. When setting the time, you must write to the hours location first and the tenths-of-seconds location last. Likewise, when reading the time, you must read from the hours location first and the tenths-of-seconds location last. You must always read or write the tenths-of-seconds location, whether or not you care about that value. The clock in CIA 2 is read and set through locations 56584–56587 ($DD08–$DD0B), which behave exactly like the locations in CIA 1. For TOD timekeeping, both CIA chips work equally well; there's no compelling reason to choose one over the other.

The following BASIC program shows how to set and read the TOD clock on CIA 1 for the 128.

```
RB 100 PRINT"{CLR}{2 DOWN}"
MX 110 GOSUB 1000:REM SET TIME
GJ 120 PRINT:PRINT
QJ 130 GOSUB 1100:REM READ TIM
       E
EQ 140 PRINT TM$;AP$:PRINT"
       {2 UP}":GOTO 130
RQ 999 REM ** SET T-O-D CLOCK
       {SPACE}TIME
HJ 1000 INPUT"ENTER TIME [HHMM
       SS]";TM$:IF LEN(TM$)<>
       6 THEN 1000
JC 1010 INPUT"AM OR PM [A/P]";
       AP$:IF AP$<>"A" AND AP
       $<>"P" THEN 1010
XH 1020 BANK 15:FOR I=0 TO 3
PP 1030 T(I)=DEC(MID$(TM$,I*2+
       1,2))
HD 1040 IF I=0 THEN IF AP$="P"
        THEN T(0)=T(0) OR 128
HS 1050 POKE 56331-I,T(I):NEXT
        I
FC 1060 RETURN
PE 1099 REM ** READ T-O-D CLOC
       K TIME
QF 1100 BANK 15:FOR I=0 TO 3:T
       (I)=PEEK(56331-I):NEXT
        I
CB 1110 AP$=" AM":IF (T(0) AND
        128)=128 THEN AP$=" P
       M":T(0)=T(0) AND 127
SS 1120 TM$=RIGHT$(HEX$(T(0)),
       2)+":"+RIGHT$(HEX$(T(1
       )),2)+":"+RIGHT$(HEX$(
       T(2)),2)
EG 1130 RETURN
```

Here's a Commodore 64 version of the same program. It's a bit longer because the 64 doesn't have the handy DEC and HEX$ functions found in the 128's BASIC 7.0.

```
RB 100 PRINT"{CLR}{2 DOWN}"
MX 110 GOSUB 1000:REM SET TIME
GJ 120 PRINT:PRINT
QJ 130 GOSUB 1100:REM READ TIM
       E
EQ 140 PRINT TM$;AP$:PRINT"
       {2 UP}":GOTO 130
RQ 999 REM ** SET T-O-D CLOCK
       {SPACE}TIME
HJ 1000 INPUT"ENTER TIME [HHMM
       SS]";TM$:IF LEN(TM$)<>
       6 THEN 1000
JC 1010 INPUT"AM OR PM [A/P]";
       AP$:IF AP$<>"A" AND AP
       $<>"P" THEN 1010
GK 1020 FOR I=0 TO 3
JR 1030 T(I)=VAL(MID$(TM$,I*2+
       1,1))*16+VAL(MID$(TM$,
       I*2+2,1))
HD 1040 IF I=0 THEN IF AP$="P"
        THEN T(0)=T(0) OR 128
HS 1050 POKE 56331-I,T(I):NEXT
        I
FC 1060 RETURN
PE 1099 REM ** READ T-O-D CLOC
       K TIME
AG 1100 TM$="":FOR I=0 TO 3
HK 1110 T(I)=PEEK(56331-I)
AM 1120 IF I>0 THEN 1140
MK 1130 AP$=" AM":IF T(0)>127
       {SPACE}THEN AP$=" PM":
       T(0)=T(0) AND 127
MR 1140 TM$=TM$+CHR$(48+(T(I)
       {SPACE}AND 240)/16)+CH
       R$(48+(T(I) AND 15))+"
       :"
GC 1150 NEXT I:TM$=LEFT$(TM$,8
       )
DJ 1160 RETURN
```

Either program can be modified to use the clock in CIA 2 simply by changing the references to location 56331 to 56587.

To use either program, enter a six-digit value for the current time and a single letter indicating whether the time is a.m. or p.m. Don't add any separators between hours, minutes, and seconds. For example, enter 9:15:00 as 091500. One idiosyncrasy must be mentioned: Because of a bug in the CIA chips, you must specify P (p.m.) when entering times between 12:00:00 midnight and 12:59:59 a.m., and A (a.m.) for times between 12:00:00 noon and 12:59:59 p.m. The proper a.m./p.m. indication will appear when the time is displayed. If you want, you can modify the time-setting routine in the programs to perform this conversion automatically.

The TOD clocks have other features, including an alarm capability. For more information, refer to Mapping the Commodore 128 *or* Mapping the Commodore 64, *from COMPUTE! Books.*

---

128 KoalaPad Picture Loader

We purchased a Commodore 128 about nine months ago and have been looking for a way to use our collection of Koala pictures in a BASIC 7.0 program. With the 128's advanced graphics commands, it should be easy for us to develop games and other programs using the Koala screens as backgrounds. Is there a program available that will load our Koala pictures directly from BASIC 7.0?

William J. Meers

Koala screens are stored in multicolor bitmap format. Each file is 10,000 bytes long. The first 8000 bytes contain bitmap information. The next 1000 bytes are screen information (the first part of the color information), and the last 1000 are for color memory. Multicolor bitmap screens get information from three sources. The bitmap determines where to look for color information for each pixel. If a pixel's corresponding bit pair is 00, the background color appears in that location. If the bit pair is 01, the pixel's color comes from the upper nybble of the associated screen memory location, and if it's 10, from the lower nybble of the screen memory location. When the bit pair is 11, an associated color memory location determines the color. (Each screen or color memory location controls a 4 × 8 block of pixels, corresponding to a multicolor character cell.)

On the 128, the GRAPHIC 3 command puts the screen in multicolor bitmap mode. The bitmap is at $2000 (8192 decimal), the screen is at $1C00 (7168), and color memory is always at $D800 (55296). The short program below loads and displays KoalaPad files.

```
RX 100 REM RESERVE BANK 1 MEMO
       RY
AD 110 POKE58,32:CLR
JM 120 REM LOAD INTO BANK ONE
XF 130 BLOAD "?PIC A*",B1,P491
       52
HK 140 GRAPHIC 3:FAST
BH 150 B2=49152:B1=8192:C2=491
       52+9000:C1=55296:S2=491
       52+8000:S1=7168
PS 160 REM DO COLOR MEMORY
GR 170 X=0:Y=0:FOR I=0 TO 999:
       BANK 1:T=(PEEK(C2+I) AN
       D 15)+1:COLOR 3,T
AM 180 LOCATE X,Y:DRAW 3:X=X+4
       :IF X>159 THEN X=0:Y=Y+
       8
GR 190 NEXT
XJ 200 SLOW:SLEEP 1:FAST
SG 210 REM DO SCREEN MEMORY
HJ 220 FOR I=0 TO 999:BANK 1:T
       =PEEK(S2+I):BANK 0:POKE
        S1+I,T:NEXT
SD 230 REM FLASH PICTURE
XR 240 SLOW:SLEEP 1:FAST
ES 250 REM DO BITMAP
EJ 260 FOR I=0 TO 7999:BANK 1:
       T=PEEK(B2+I):BANK 0:POK
       E B1+I,T:NEXT
JE 270 SLOW
RH 280 REM READY TO GO
```

The program first BLOADs the file into an available section of memory and then POKEs the values into their proper locations. The program takes about two minutes to run. Change the filename in line 130 to the name of your picture.

ML Sector Reader

Can you show me how to read a track and sector in machine language on the 64? Currently, I'm using the LADS assembler. Could you also print a list of the 64's built-in Kernal routines, describing what each does?

Fred Becker

The short program below is adapted from the routine RDBUFF *in COMPUTE! Books'* Machine Language Routines for the 64 and 128. *Enter it using a standard machine language monitor, or with your assembler. When executed, this routine reads the first block of the directory (track 18, sector 1) into a buffer within the disk drive, and then copies this buffer into memory at $C06D, just past the program.*

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First, the disk command channel must be opened ($C039–$C049) using secondary address 15. Next, an internal disk buffer is allocated, with the equivalent of OPEN 1,8,3,"#", at $C04A-$C05E. The secondary address, 3 in this case, is important. It must be used in the block-read command.

The string U1,3,0,18,1 *sends five pieces of information to channel 15 ($C006–$C018).* U1 *is the sector-read command to the disk drive. The* 3 *corresponds to the secondary address of the buffer (the* 3 *in OPEN 1,8,3). The* 0 *is the drive number (if you have a dual drive such as the MSD, you could use 1). The* 18 *and* 1 *are the track and sector numbers, respectively, for the block to be read.*

When the 1541 or 1571 receives the U1 command, it copies the given disk sector into memory inside the disk drive. All that remains is to read the data into the computer's memory. At this point, we CHKIN with a 1 (the 1 in OPEN 1,8,3), to specify logical file 1 as the channel to be read, and then loop 256 times with CHRIN, to read the bytes and store them.

Finally, logical files 1 and 15 are closed and the program is done.

This routine relies heavily on the 64's built-in Kernal routines. Because of space limitations, we're unable to provide a detailed description of these routines, but there are several books that cover them, including the Programmer's Reference Guide, Mapping the 64, *and* Mapping the 128.

```
; open the command channel
C000 20  39  C0      JSR  $C039
; open a disk buffer
C003 20  4A  C0      JSR  $C04A
; designate channel 15 for output with
CHKOUT
C006 A2  0F          LDX  #$0F
C008 20  C9  FF      JSR  $FFC9
; send the block read command
("U1,3,0,18,1")
; to channel 15
C00B A0  00          LDY  #$00
C00D B9  60  C0      LDA  $C060,Y
C010 F0  07          BEQ  $C019
C012 20  D2  FF      JSR  $FFD2
C015 C8              INY
C016 4C  0D  C0      JMP  $C00D
; restore output device with CLRCHN
C019 20  CC  FF      JSR  $FFCC
; open logical file 1 for input with
CHKIN
C01C A2  01          LDX
#$01
C01E 20  C6  FF      JSR  $FFC6
; get a character from disk buffer with
CHRIN
C021 A0  00          LDY  #$00
C023 20  CF  FF      JSR  $FFCF
; store it to memory beginning at $C06D
C026 99  6D  C0      STA  $C06D,Y
; next character
C029 C8              INY
; read 256 characters (until .Y wraps to 0)
C02A D0  F7          BNE  $C023
; close the disk buffer (logical file 1)
C02C A9  01          LDA  #$01
C02E 20  C3  FF      JSR  $FFC3
; close the command channel
C031 A9  0F          LDA  #$0F
C033 20  C3  FF      JSR  $FFC3
; restore input device with CLRCHN and
exit
C036 4C  CC  FF      JMP  $FFCC
; Subroutines start here
; file number
C039 A9  0F          LDA  #$0F
; device number for disk drive
C03B A2  08          LDX  #$08
; secondary address for command
channel
C03D A0  0F          LDY  #$0F
; 15,8,15 is set to be opened with SETLFS
C03F 20  BA  FF      JSR  $FFBA
; length of name is zero
C042 A9  00          LDA  #$00
; set filename to "" with SETNAM
C044 20  BD  FF      JSR  $FFBD
; open command channel and RTS
C047 4C  C0  FF      JMP  $FFC0
;
; logical file number
C04A A9  01          LDA  #$01
; disk drive
C04C A2  08          LDX  #$08
; secondary address
C04E A0  03          LDY  #$03
; 1,8,3 is set to be opened with SETLFS
C050 20  BA  FF      JSR  $FFBA
; filename is one character
C053 A9  01          LDA  #$01
; point to "#" which specifies
; a drive buffer
C055 A2  5F          LDX  #$5F
C057 A0  C0          LDY  #$C0
; set filename to "#" with SETNAM
C059 20  BD  FF      JSR  $FFBD
; open the drive buffer with OPEN and
RTS
C05C 4C  C0  FF      JMP  $FFC0
;
; ASCII "#"
C05F 23
; ASCII "U1,3,0,18,1" follows
; "U1," - U1 is block read
C060 55  31  2C
; "3," - 3 is secondary address
C063 33  2C
; "0," - 0 means drive zero
C065 30  2C
; "18," - 18 is track number
C067 31  38  2C
; "1" - 1 is sector number
C06A 31
; carriage return and 0 end to end
command
C06B 0D  00
```


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Printer Commands

After reading your article about printing Commodore graphics, I have some questions. Apparently the only way to get essentially gapless linefeeds is with a CHR$(8) command. But if you want to print keyboard graphics, will sending a CHR$(15) after the CHR$(8) work? Heretofore I have had the impression that gapless lines and keyboard graphics are mutually exclusive. I'm writing a program that needs this capability and have no Commodore printer on which to test it.

The article said the 1526 and MPS-802, while not having a hi-res graphics mode, do have adjustable line spacing. You give an example using channel 6. What is the increment of the CHR$(X) call? Some printers are 1/100 inch, some are 1/72 inch, some 1/144 inch.

You allude to a variety of public domain programs for screen dumps, but do not name any sources. I'd like to know where to find a public domain hi-res dump program.

Ben Johnson

The first thing to understand about Commodore printers is that there are two broad families in which they fall and that the command codes for graphics are unique to each family. In the first group (the graphics printers) are the 1525, MPS-801, MPS-803, MPS-1000, and MPS-1200. In the second group (nongraphics) are the 1526 and MPS-802.

The CHR$(8) and CHR$(15) codes apply to the first group only; they don't work on the 1526 or 802. Sending a CHR$(8) to the printer puts it in hi-res graphics mode. Sending a CHR$(15) switches the printer back to text mode (which might be either upper-/lowercase or uppercase/graphics, depending on which character set you've selected). In graphics mode, the printer prints eight lines per inch. In text mode, it prints six lines per inch, with a small gap between lines to enhance readability. If there were no gap, the lines would be stacked on top of each other, with no space at all between adjacent lines.

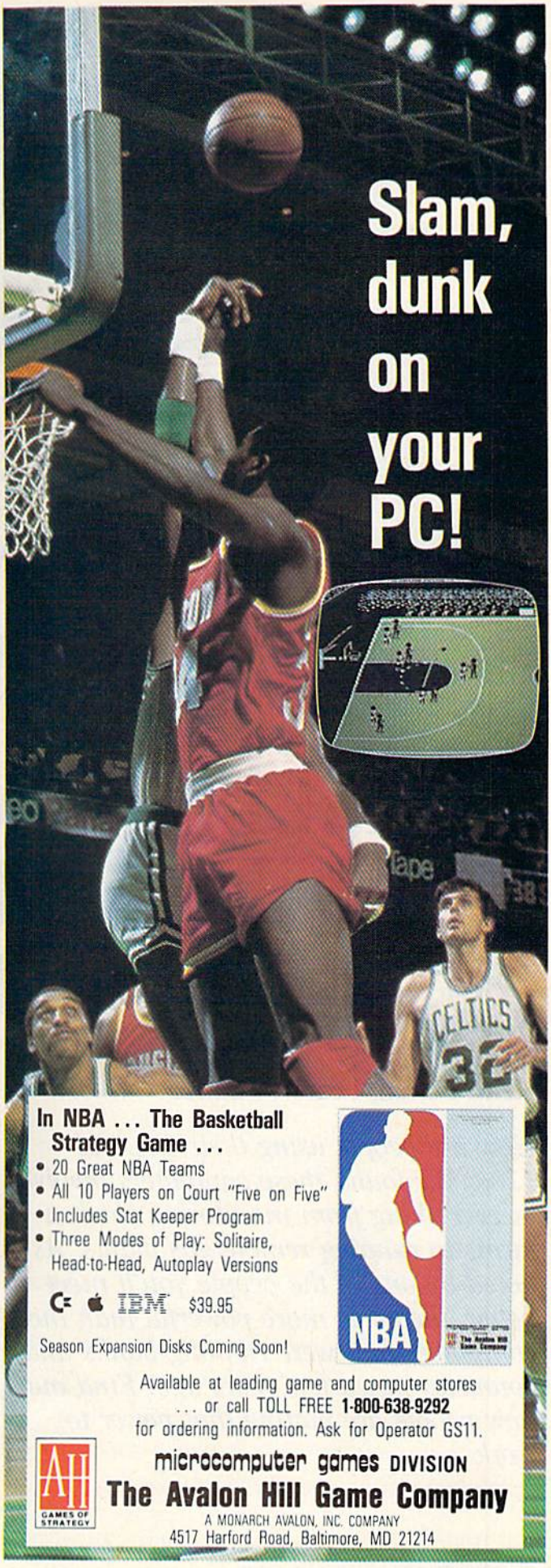
The way to print text with no gaps between the lines is relatively simple. At the start of a line—at the left edge of the page—send a CHR$(15). Now the printer is in text mode and prints the characters as it receives them. As the very last character in the line, send a CHR$(8) that's not followed by a semicolon, which adds RETURN. Since the printer is in hi-res mode, it advances without a gap to the next line, which again should begin with a CHR$(15) to switch back to text mode.

For 1526s and MPS-802s, you shouldn't send the CHR$(8) and CHR$(15). Instead, at the beginning of the program, include the following line:

```
1 OPEN 6,4,6: PRINT#6,CHR$(24);:CLOSE6
```

The steps between lines are either 1/144 inch or 1/216 inch, depending on whether you read the old manual or the new one. Our experience with the 1526 and 802 indicates that 1/216 inch is probably correct, although 1/144 inch might be the spacing on older models of the 1526, of which there are at least two versions. The CHR$(24) sets line spacing to 24/216 inch (8.1 characters per inch).

There are several sources for public domain programs. Although GAZETTE programs aren't in the public domain, we've published at least four hi-res screen dump programs (for both families of Commodore printers), the most recent of these being "Screen Dump Set for the 128" (September). We also have an extremely fast hi-res screen dump program for the 128 and 64 with any Commodore printer slated for publication in an upcoming issue. For truly public domain programs, check with a local user group. If there are none nearby, nothing prevents you from joining a user group long-distance (you wouldn't be able to attend meetings, but you could benefit from the disks of public domain programs). If you have a modem, there are thousands of bulletin boards and several large telecommunications services that you could check for hi-res screen dump programs.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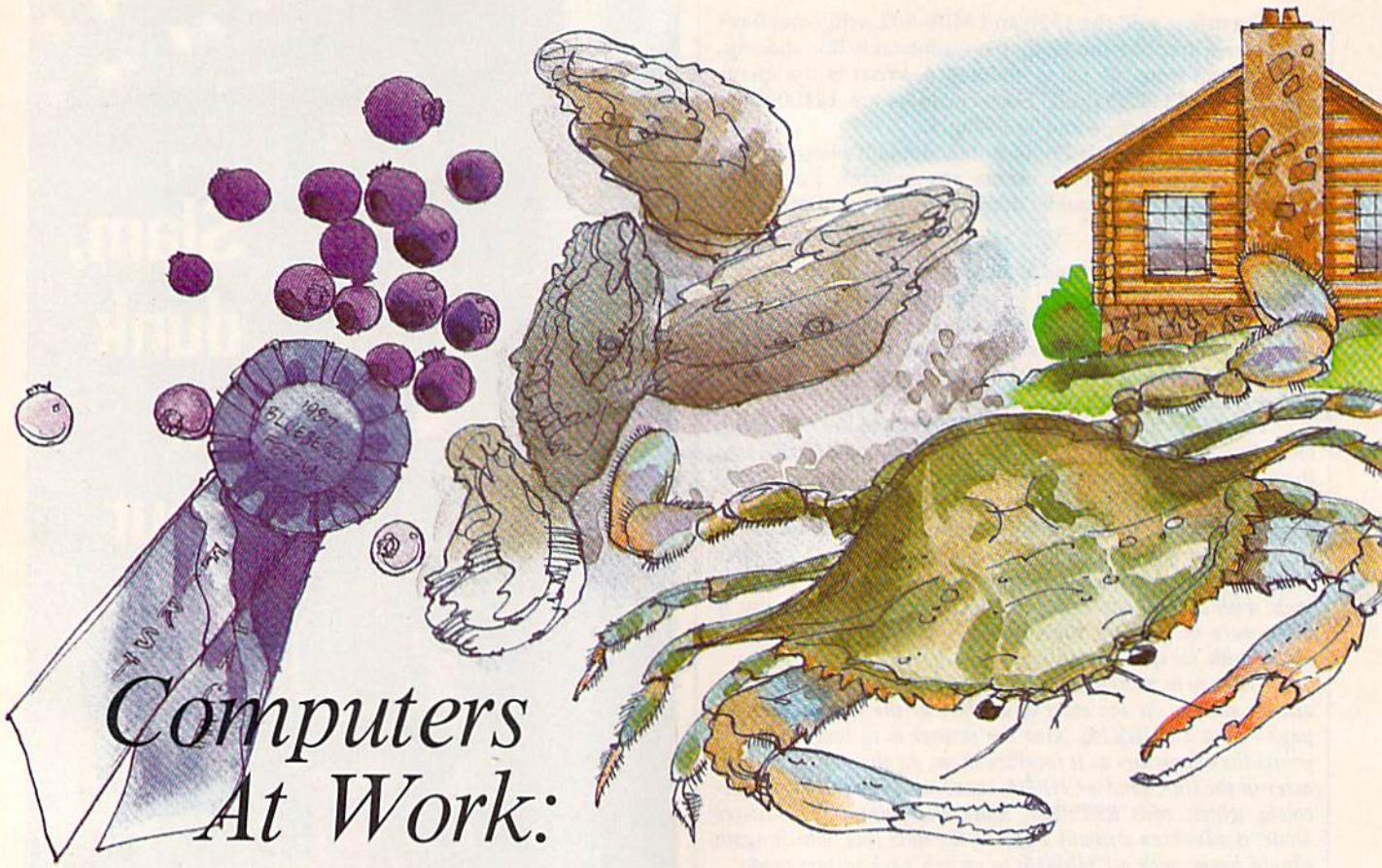


Computers At Work:

Making Friends, Making Money, Making The Grade

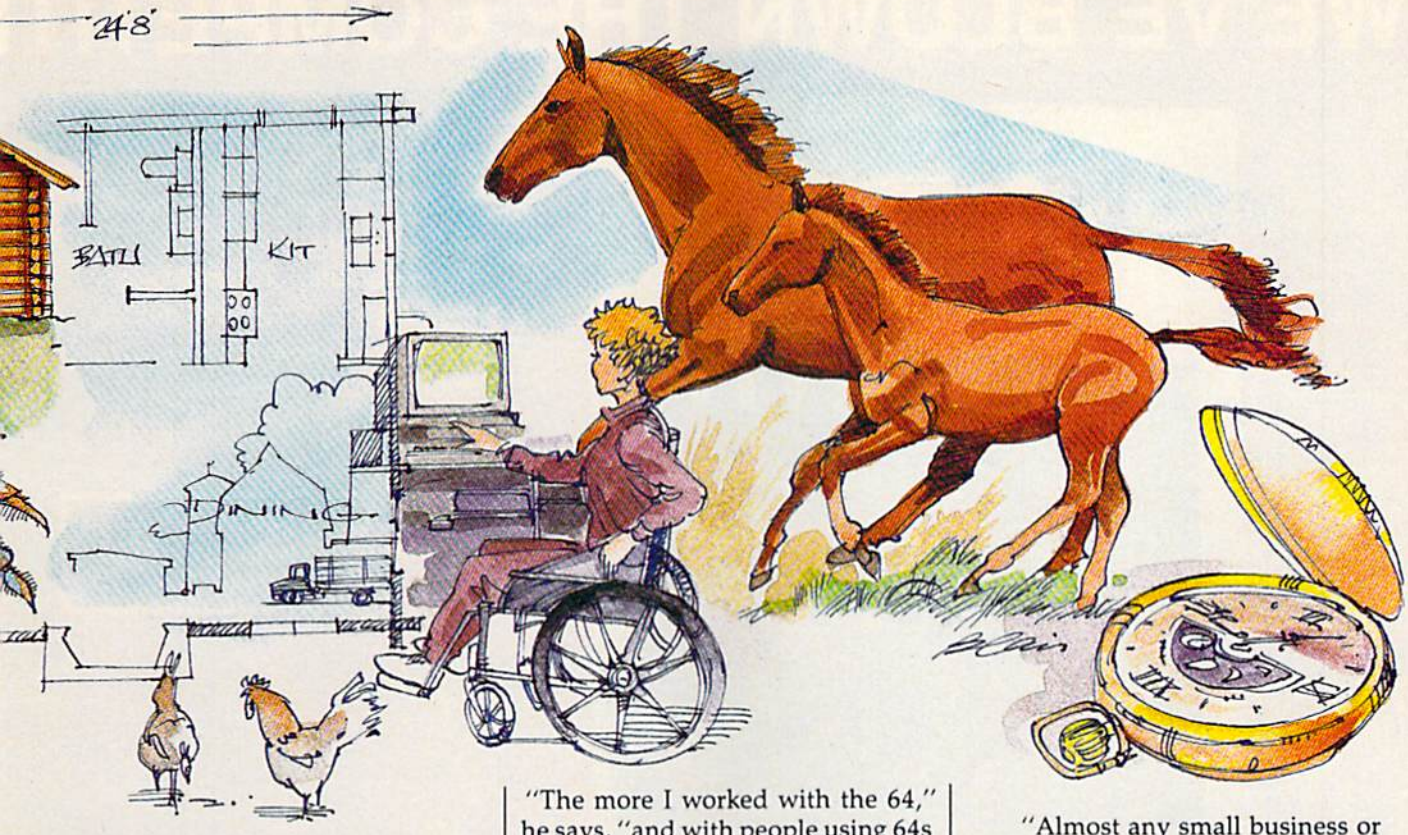
Keith Ferrell, Features Editor

How are people using their 64s and 128s? We found these computers involved in everything from monitoring chicken farms to running remote gas plants. As noted by one of the people you'll meet below, the 64 is more powerful than the computers that were running banks and countries just a few years ago. Find out how people are putting that power to work.

People will always find new uses for the versatile Commodore 64 and 128. The GAZETTE talked to some subscribers and found out that their machines are more productive than ever.

The versatility of the machines—and the huge base of applications software available for them—is matched by the variety of applications they're used for. Perhaps not surprisingly, many of those applications are business related. Many people have found Commodore 64s and 128s to be perfect computers for managing small businesses—and some not so small businesses. More than a few of the users we spoke to count on their Commodores to help manage enterprises grossing a million dollars or more a year.

There's an altruistic side to Commodore users as well. It would be hard to estimate just how many community, charity, and civic functions get a helping hand from citizens with skills, Commodores, and the urge to volunteer.



Disk-Based Publishing

Six years ago Don Vandeventer started publishing a periodical called *The Home Business Directory.* "I did the magazine on a typewriter and I was going nuts," Vandeventer recalls. "I was looking for a computer but, to be honest, I wasn't looking for a Commodore. I didn't think it would meet my needs."

Then he saw a demonstration of *OmniWriter.* On the strength of the demonstration of that word processor, Vandeventer bought a 64 and immediately began producing his magazine on it. "I was very pleased with the power the 64 and *OmniWriter* gave me," he says.

As a result of his own cottage industry success, Vandeventer was asked to do articles for publications including *The Mother Earth News* and *In-Business.* "The articles evolved into consulting and writing assignments from other magazines."

While the 64 served him well, Vandeventer purchased a 128 as soon as it was available. "In addition to word processing, I do a lot of one-on-one consulting about using Commodore systems in home businesses," Vandeventer says.

Gradually, he found himself becoming more and more familiar with the variety of programs available for business use on the 64. "The more I worked with the 64," he says, "and with people using 64s in business, the more I was impressed. Today, we may measure by the standards of an IBM or a Macintosh or the Amiga, and they're just an entirely different class of computer.

"But we forget that just a few years ago entire banking systems and countries were run with less computer than our Commodore 64."

Nor does Vandeventer believe the 64 has been entirely superseded by these new machines. Too often, he notes, first-time computer purchasers are steered to machines they don't need. People don't have to have 640K of RAM or a hard disk drive, he says. "For many home and small business applications, the 64 and the 128 are ideal solutions."

Having encountered so many satisfied 64 and 128 users who were using their machines successfully in small businesses, Vandeventer perceived another publishing niche. A little over a year ago he started a new magazine, *Commodore Money Machine,* aimed at the entrepreneur. With a subscription base of 3000, *Commodore Money Machine* is growing steadily.

Do the 64 and the 128 still offer opportunity for the entrepreneurial user? According to Vandeventer, there are plenty of opportunities available.

"Almost any small business or cottage industry," he says, "can use a 64 or a 128 and software. Whether it's word processing, mailing lists, creating flyers to be mailed out, producing small catalogs or newsletters—you're really not limited."

Citizen Elder

In 1982, George Elder, of Cornelius, Oregon, found himself shut in after a coronary. While convalescing, Elder began doing work for a number of local civic and service organizations. Using a typewriter, Elder compiled data, designed forms, and wrote reports and resolutions.

"Because my spelling was atrocious," Elder recalls with a laugh, "I needed something that would provide spelling correction." Elder purchased a 64 and began configuring a system that would meet his needs. "I finally came up with a system that included a dual disk drive and a printer."

Now he maintains databases on all the key individuals in Cornelius, economic development council information, and other matters of local interest. Elder works his equipment hard—since 1982 he's gone through two CPUs and a disk drive.

Working out of his home, Elder now serves two communities in various ways. "We just had a Blueberry Festival," he says, "and most of the

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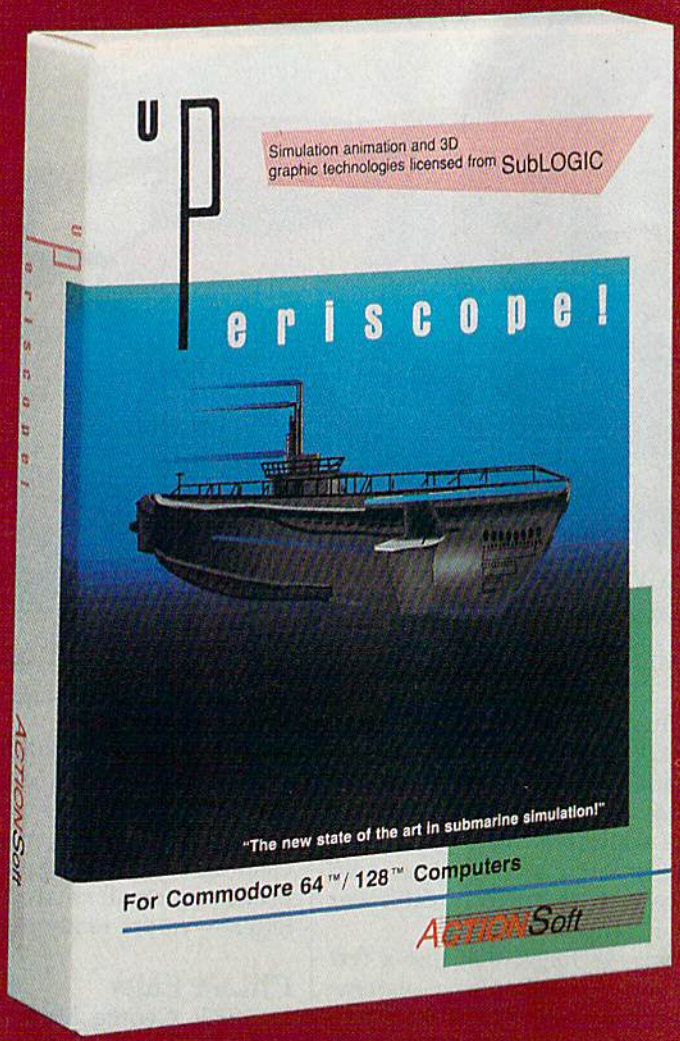
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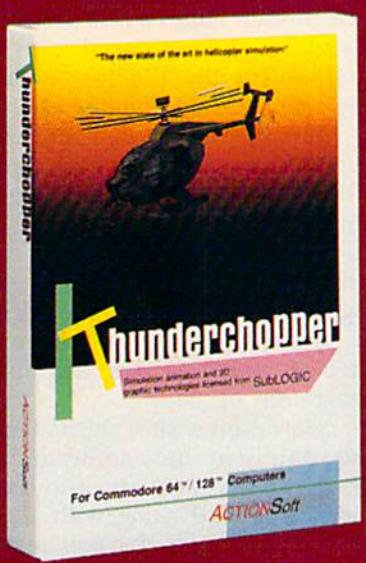

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small signs, and all of the record keeping and project planning were accomplished on my equipment."

In addition to word processing and a spelling checker, Elder uses database, spreadsheet, and desktop publishing software for the various activities he and his 64 undertake. Elder's health restricts him to his home much of the time. With his 64, he doesn't mind the confinement as much.

"I put in 8 to 12 hours a day in my office," he says. His system has grown since he purchased that first 64. "Now there are two 64s, a drawing board, a copy machine—wall-to-wall equipment!"

Does the 64 hold up under the amount of work Elder produces on it? Absolutely. "I think that for anybody with a small business, just getting started, the 64 is the ideal machine for an entrepreneur on low budget, setting up. It's to his advantage to have the 64, because everything that the bigger machines will do is available for the 64. It's just a matter of deciding which programs you need to do your jobs. It's the most cost-effective computer system around."

Logging On

Timberline Log Homes of the Bitterroot Valley in Montana is a custom manufacturer of log homes. For the past three years, mill manager Sven Abrahamsen has used a 64 to keep a close tally on all of the logs required for each home the company is commissioned to produce. A home can require anywhere from 100 to more than 400 separate logs, each of them pre-cut.

Abrahamsen uses a database to keep track of the list of cut logs, as well as to monitor production. "We don't want to send a house across the country and then find out we're missing two logs and have to freight them out," Abrahamsen notes. Using the 64 to track the logs, Abrahamsen says, "we've found that the 64 pays for itself many times over."

At home, Abrahamsen has a 128 he uses for a variety of purposes, one of which is a community birthday calendar. "Every year we print out a calendar that includes about 800 people from the community." The calendar is a fund-raising project with individuals paying to have their names included. "I sort the names by date and print them out for the calendar," Abrahamsen says.

Farm Equipment

For the past year, Doris Harrelson has been using her 128 to keep track of both her seafood business and her farm. She uses the machine to follow the amount of oysters and crabs purchased for Captain Stan's Seafood, as well as for managing a farm with more than 20,000 chickens.

Located in Wenona, Maryland, Harrelson notes that at present she's purchasing about a hundred bushels of hard crabs a week. "And this is a slow period," she says. "We also have a softshell business where we purchase peelers, and then we shed them out. We keep track of all different sizes." Harrelson ships seafood to several states.

Using *Vizastar* and *Vizawrite*, Harrelson tracks a variety of information and handles company mailings. "I enter in my monthly figures, and then the program is automated, producing a monthly statement that can be five pages long—which shows you how complicated a seafood operation can be!"

The 128 comes in handy for the chicken farm as well. "I use the machine primarily in the chicken raising," she says. "The computer lets me get averages of the feed we use, and so on."

Harrelson is satisfied with the 128, although she would like to see more software designed to run in 128 mode. That caveat notwithstanding, she's pleased with the contribution the 128 has made to her business over the last year.

She appreciates the 128's simplicity of operation, as well as the efficiency of the software she uses. "Being a novice at using a computer," Harrelson says, "I'm sure that there are things I could be doing that would consolidate a lot of my work. But I just don't have the time to spend a year learning a program."

Harrelson wishes she had more time simply to study software. "But the oyster season is about to start," she notes, "and along with all the other information, I have to keep track of how many bushels of oysters we buy and, once we've shucked them, how they come out. There are four different grades, and we track how many of each bushel come out. The 128 and *Vizastar* have set all this up for me."

Reaching Out

As a result of a blood disease, Sharon Serpe, of Bayonne, New Jersey, finds herself occasionally confined to her home. During such times she uses her 64 and QuantumLink to keep in touch with the rest of the world.

"On QuantumLink there are lots of different clubs. One of them is called the disABILITIES Club," Serpe says. "I find it to be very helpful in a lot of different ways."

The disABILITIES Club meets at various times, on QuantumLink, with various topics, discussion groups, and areas of interest. Serpe goes online at least once a week.

In what ways is the club helpful? "One, the people alone are helpful. When you're ill, there aren't many people you can talk to about your illness. But when you're online, you can talk with people who've been there themselves. They relate to you, they understand. I've made a lot of friends through the club."

Serpe also calls upon members of the club for advice and information. "If I have any questions about my disability, there are people there to answer my questions."

Conversation flows both ways, Serpe points out. In addition to asking for information, she finds that others seek her out. "If there's something on someone's mind, or they need someone to talk to, you can go to a 'private room' and discuss your problems and help each other out."

Serpe has had her computer for about six months, and quickly overcame her initial nervousness about using the machine. She likes the fact that her 64 provides an opportunity to get in touch with people who might otherwise not get in touch with each other. "You can talk to up to a dozen people at a time," she says.

Would she recommend a 64 and modem for people who are restricted to their homes. "I sure would," she says. "I find sometimes, when I'm disabled and have to stay home, that the 64 gives me a lot of things to do and keeps my mind occupied."

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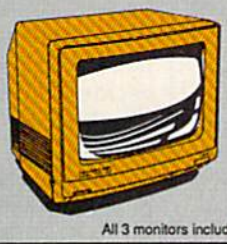

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Don Reynolds has set up four 128s as remote monitors/controllers for small, unmanned gas plants producing liquid nitrogen, oxygen, and argon for businesses that include frozen foods and hospitals. "Most of these unmanned plants," Reynolds says, "are in remote locations. It used to be that we'd send a man out to one of these plants about once a week. Whenever one of the plants would shut down, we'd also have to send a man out there, which takes quite a bit of money." It made sense to Reynolds to try to computerize as much of the operation as he could.

Three years ago, the first time he converted a plant, Reynolds tried using a 64. "That didn't really work," Reynolds says, "so we switched up to the 128, mainly for the 80-column display and the expanded memory." Those features allow the machines to be used to keep hourly and daily averages of gas production.

Reynolds wrote a program, "Remote Operator," and a colleague designed the hardware interfaces. "The program is similar to a BBS," Reynolds says. "It operates in the same way. You sign on with an ID and a password, then work through a series of menus. From the menus we retrieve analog information, temperature information, and digital information. We have a series of digital outputs that lets us start and stop equipment remotely."

The 128s are also constantly scanning for alarms. "They run 24 hours a day," Reynolds explains, "just like a bulletin board. An operator at our main facility has the duty of calling each plant every day and getting a page of information from each of the plants."

If a 128 detects an alarm, it calls the main facility. "The 128 logs on to our host computer and lets us know which of the remote plants is having a problem." The operator then calls the 128 to find out what the specific problem is. It's particularly impressive that many of those problems can be corrected over the phone link with the 128. "If not," Reynolds says, "we send someone out to fix the problem."

Each of the plants is equipped with a 128, a 1571 disk drive, a 1670 modem, and a color monitor. The largest of the plants produces, daily, close to a million cubic feet of liquid nitrogen.

On his own time, Reynolds uses a 128 for programming and a 64 to operate a bulletin board.

Old And New

For a year and a half, Stoney Sikorski kept the books for two antiques businesses on her 64. Although she's recently upgraded to an Amiga, she still keeps her 64 on her desk.

Sikorski has run both an antique-watch business and an antiques brokerage on her 64. "I used *OmniWriter* not only for correspondence, but also for generating appraisals of antiques," she says.

For spreadsheet work she used *VizaStar*, which she adapted for bookkeeping and accounting purposes. "I also used *VizaStar* and the 64 to keep track of inventory," she says.

Having moved to the Amiga, Sikorski retains a fondness for the 64. "It did everything I wanted it to do," she says. "I got the Amiga simply because of the increased speed, graphics, and memory it offered. The businesses I ran with the 64 were a little bit smaller, but everything I do now [on the Amiga] I did then. I couldn't imagine running a business without a computer."

She plans to give the 64 to her son when he's a little older.

Horsepower

Honeycutt Farms is an 88-acre thoroughbred–horse boarding and training farm with as many as 80 mares, foals, and yearlings. That many horses—and customers—generates a lot of records, and Honeycutt Farms manages those records on a Commodore 64.

"We've had our 64 about three years," reports Diane Hays. "We use it for all of our health records, our billings, and to keep track of mares and foals."

Billings are accomplished using *Superbase*, with all other records kept on *PFS File* and *PFS Report*. Hays says that the 64 delivers plenty of capacity for the purposes they require, although there has been some discussion, recently, of upgrading to a 128.

Despite some early nervousness about the computer, Hays is now relaxed and comfortable with using it. "Over the period of time that I've used the 64, I've found that it's very simple to operate and very adequate for our needs," Hays says.

Meeting The Challenge

Tom Schlechte depends on his 128 and a carefully slected group of software to keep track of more than 600 customers for Atlantic Filter, a water filtration equipment company, and supplier of chemicals and salt to businesses in the Lakeland, Florida area.

Setting up invoice and receivables records for hundreds of customers was a challenge, but a challenge Schlechte was eager to undertake. He wanted to prove something. "You don't have to go out and spend five or ten thousand dollars to do the accounting for any small company," he says.

Having begun with a 64 in 1985, Schlechte's system now includes a 128, dual 1571 drives, and a Star SG10 printer. For business applications, Schlechte believes that the dual drives are all but indispensable. "Once we've loaded the program and put customer data in one drive, and numbers on the second drive, we don't have any disk-swapping problems at all," he says.

Ease of use and training was one of the attractions of the Commodore system. Schlechte applied the same standards to the software he selected. "In fact," he notes, "we decided on the software we would use before we decided on the computer."

He recommends that those people considering using their computer for business purposes spend some time studying their needs and the ways in which computerization can meet those needs. Schlechte has only a few reservations about the solution he selected.

"The one problem is that we still have not found any 128 software that suits our needs," he says. "So we're still using 64 software and using the 64 mode on the 128. It's been kind of a disappointment. But the first software company that comes up with an effective accounting program for the 128 is going to make some money. With the right software, you've got something that can be a very serious business machine."

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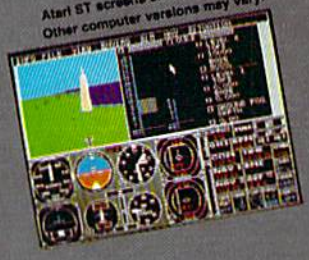

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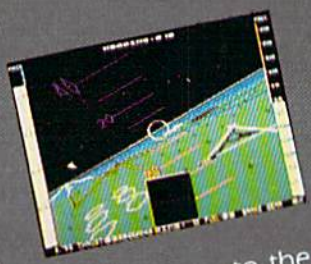

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Lt. Kernal Hard Disk Drive

Put simply, I think the Lt. Kernal Hard Drive by Xetec is the most powerful peripheral device available for Commodore 64 and 128 computers. No other peripheral enhances and expands these computers' capabilities to the extent that the Lt. Kernal does.

Hard disk drives have been available for the 64 and 128 for several years. Several hard drives are presently on the market, including the Lt. Kernal, in a price range that, while expensive, is within the reach of many users. In fact, the Lt. Kernal itself has been around for some time. This latest version is a reincarnation of a hard drive of the same name originally marketed by Fiscal Information, a mainframe and minicomputer company. As a result of the developers' big systems expertise, several features of the Lt. Kernal reflect capabilities primarily found on mainframe and minicomputers.

But the Lt. Kernal is a microcomputer peripheral, and elements of its design display a careful understanding of the market. The hard drive is contained in a sturdy metal housing, which also contains its power supply. The housing leaves a fairly large footprint, with dimensions of 14-inch (width) by 12-inch (depth) by 3-inch (height). Fortunately, the housing is strong enough to sit beneath and act as a stand for the monitor, making it easier to fit the drive into restricted work spaces.

In addition to the drive, an interface, which Xetec labels the host adapter, is required for use with the 64 and 128. The host adapter is inserted into the cartridge port on the back of the computer and is connected to the hard drive by cable.

Once the drive is hooked up, you might want to take a while to survey its capabilities. First of all, the hard drive has a standard capacity of 20 megabytes of storage space, which is roughly the equivalent of 120 single-sided floppy disks. The hard drive's storage space can be divided up into 11 different logical units, which in turn can be divided into 15 separate subdirectories.

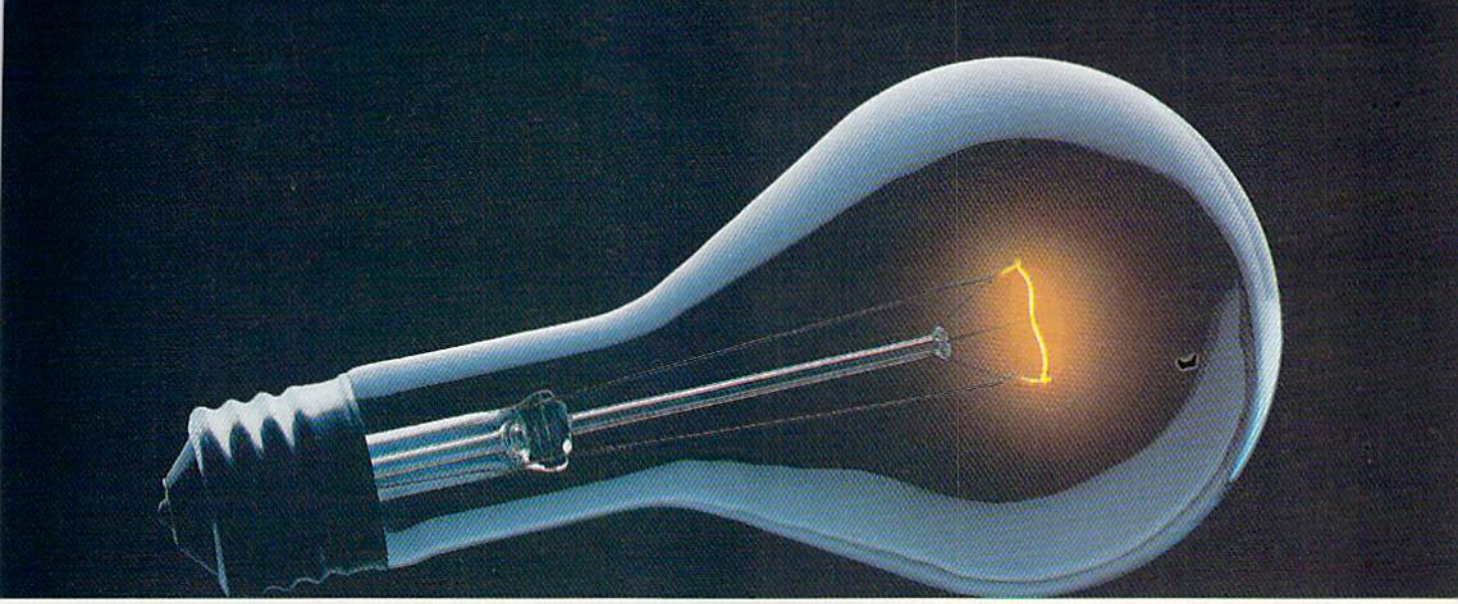
The benefits of the capacity almost pale beside the speed the Lt. Kernal delivers. Its load and save speeds are over 100 times faster than the 1541 disk drive. In fact, load time becomes almost irrelevant—most software programs are up and running almost instantly.

After you switch on the power, the hard drive automatically runs itself through a series of diagnostic examinations. Once the diagnostics are passed, the entire system activates and gives you the READY prompt. From that prompt, you can type in the name of a program you wish to run without using a RUN or LOAD command. Also, the drive can be instructed to automatically execute an application program upon successful power up.

The Lt. Kernal supports both 128 and 64 modes of operation. By way of the CONFIG command, the user can access a configure program stored on the drive that permits the user to define which mode of operation the drive will be in after booting up. Additionally, CONFIG allows the user to set the default parameters for other aspects of operation, such as the default logical unit number, device number, and so on. By the time you read this review, Xetec was to have revised the operating system to support the CP/M mode of operation (on the Commodore 128), as well.

The Lt. Kernal disk operating system (currently version 6.3) has or enhances 42 system commands of the 1541's DOS. These commands can be divided into four basic categories. First, there are commands that relate to file management, such as COPY, which copies a file from one file or directory to another within the hard drive. The second category of commands includes commands designed to simplify programming, such as RENUM, which renumbers BASIC program lines, or OOPS, an often life-saving command that will attempt to recover the most recently deleted file.

The next category includes commands that aid in the management of KEY files, a built-in "keyed-index, random access method" file system. KEY files are similar to relative files and are used by sophisticated database man-



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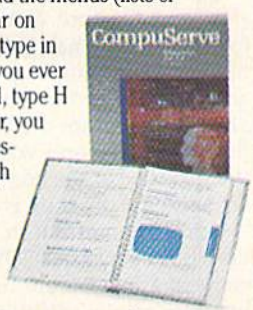

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agement software for the quickest and most flexible method of storing and retrieving data. The KEY file system does not have to be mastered—or even used—to take advantage of the Lt. Kernal. I'd point out, though, that the KEY file system is a programmer's dream, permitting the user to design a custom database system to fully exploit the speed and storage capabilities of the Lt. Kernal. A Commodore 64 or 128 together with the Lt. Kernal hard drive, via the KEY file system, can provide its user with a serious computerized data management system that will rival that of any microcomputer system.

There are a few other commands that deserve special attention. FASTCOPY is a copy command that permits the user to quickly backup and/or restore data between the Lt. Kernal and a floppy drive. While the Lt. Kernal is sturdily constructed, made to stand up under commercial use, it can be prone to the same electronic failures that bring down any piece of equipment. Backing up data is essential even for systems as reliable and durable as the Lt. Kernal, and FASTCOPY offers a quick and painless storage backup method. Use it.

One of the most interesting commands available on the Lt. Kernal is ICQUB, (pronounced as *ice cube*). ICQUB operates much like the Snapshot and Capture cartridges available for the 64, in that ICQUB captures a memory-resident program in 64 mode and stores it to the hard drive. Thereafter, the program can be invoked from the hard drive and will be restored to the memory of the computer at the exact point the program is captured. Xetec is quick to point out in its documentation, however, that ICQUB is not a software pirating feature, as the captured program can be run only from the hard drive. Copies of the captured program stored to a floppy disk will not run.

ICQUB's value is that it permits you to run copy-protected software from the Lt. Kernal. This is a value to users not only in permitting them to back up their copy-protected software, but also in allowing their copy-protected software to take advantage of the Lt. Kernal's loading speed and other advantages. I tested the ICQUB feature with several different copy-protected commercial programs. Most programs that are completely memory resident were successfully captured with ICQUB, although several programs took more than one attempt to gain success. I might also point out that some of the latest copy-protection schemes employ a "dongle" or security key that goes either in the joystick ports or the cassette port. This type of copy-protection will not be defeated by ICQUB, and those security devices must be used to successfully run the program from the hard drive.

As indicated above, the Lt. Kernal is designed with an experienced programmer in mind. Not only is it equipped with a sophisticated KEY file system, usually found only on mainframe and minicomputers, but it also has several enhanced commands to aid in programming. The Lt. Kernal's disk operating system allows up to seven files to be open for reading and writing simultaneously, in addition to the commands/error channel. All of these features, together with the speed and storage capacity of the drive, provide the programmer with an excellent environment for the design and testing of software.

The benefits of the drive's 20-megabyte storage capacity almost pale beside the speed the Lt. Kernal delivers. Its load and save speeds are over 100 times faster than the 1541 disk drive. In fact, load time becomes almost irrelevant.

There are some reservations to consider with respect to the drive, mostly derived from the complexity of the Lt. Kernal operating system and what the drive has to do to enhance the 64 and 128's capabilities. The biggest reservation I have is that the Lt. Kernal requires some internal modifications to the computer. The manual carefully takes you step-by-step from opening the computer case to exchanging a certain microchip to the running of additional wires within your computer. Needless to say, such procedures are dangerous to the health of your computer, and one wrong move could result in failure of your entire system.

While the Lt. Kernal will work in the 128 mode of the Commodore 128, it will not work properly together with a 1571 disk drive—unless the 1571 is locked into the 1541 mode or an additional cut and patch job is made within the computer to coordinate the Lt. Kernal's activities with that of the "burst" speed capabilities of the 1571 drive. If one of these steps is missing, disk operations on the 1571 are unreliable. This problem is not documented by Xetec in the manual accompanying the Lt. Kernal.

Since the cut and patch job within the computer should be done only by a professional technician, Xetec does not provide users with the information to make the cut and patch job until they can demonstrate to Xetec that they can do the modification without damaging their computers. As an alternative, however, Xetec will help users design a modified cable that will run between the 1571 and the computer that will prevent the drive from going into "burst" mode.

I also have a few problems with the manual accompanying the drive. On one hand, it provides excellent information describing the new and enhanced system commands available on the Lt. Kernal and examples of their use. Also, the manual goes into helpful detail concerning general programming considerations and the use of the KEY file system. On the other hand, I ran into several basic problems that were not documented. For instance, the ICQUB command invokes the menu-driven ICQUB program. I was not able to successfully capture a program using ICQUB until I learned from Fiscal Information that both the Lt. Kernal and the floppy drive had to have the same device number.

Nor does the manual warn you that switching the power-up mode of operation from 128 to 64 (CONFIG) without making a corresponding clock speed change could leave you in the 64 mode with a two-megahertz clock speed—which might be interesting for programmers, but leaves most users blinded with a scrambled composite monitor screen. Having accidentally stumbled into this pitfall, I had to blindly enter commands to the Lt. Kernal and move through the CONFIG menus by memory in order to reconfigure the system to restore the proper monitor screen.

The Lt. Kernal is a terrific peripheral for the Commodore computers, but it's not for every Commodore computer user. Its current price range makes it a relatively expensive peripheral, considering that hard drives for IBM-clone computers are running in the $300 to $400 range. At this price, many of the advanced features of the Lt. Kernal will be worthwhile primarily for the experienced programmer, BBS operator, or the small business user—but it seems steep for the average user.

At the same time, the prices of computer peripherals have historically come down, and, because the Lt. Kernal is such a valuable peripheral, it wouldn't have to come down far before a hard disk becomes a serious consideration for most 64 and 128 users.

—*Scott Thomas*

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Jeremy Silman's Guide To Chess Openings and *50 Classic Chess Games*

Learning to play chess is easy; learning to play chess *well* is an entirely different matter.

Millions of people pick up the rudiments of the game, enough to move the pieces around the board with some familiarity. But far fewer take the time or effort to really understand some of the basic concepts and lines of play that make chess such an intriguing and challenging game. Like tennis players, there are chess enthusiasts at every level of performance—from those who can barely bat the ball across the net to those who can routinely make diving cross-court backhand volleys that land just outside their opponents' reach.

It takes regular play, a commitment of time, and concentration to get beyond the beginner's stage, to understand the underlying concepts and the many lines of play that have proven successful over the centuries. Chess offers an inexhaustible supply of new positions, problems, and challenges with every setup of the board. On the other hand, there *are* road maps that experienced players have learned to help keep them away from dead ends and perilous routes.

While there are a profusion of computer chess programs available for Commodore 64 and 128 owners, few of the packages offer in-depth and annotated instructions to help novice players understand these well-traveled roadways. One of the first and best of this instructional genre, however, is *Paul Whitehead Teaches Chess* (reviewed in the July 1986 issue).

That package, produced by Enlightenment, offers not only a detailed interactive instructional program but also an excellent chess opponent program, the *Coffeehouse Chess Monster*, that lets you practice what you're learning by playing against the computer or against another player. By using an extensive branching system of examples and explanations on game play, beginners and experienced players alike can cover virtually every aspect of the game of chess.

The same approach has been taken in another Commodore 64 program, also available from Enlightenment, called *Jeremy Silman's Guide to Chess Openings*. But here, rather than starting from the very beginning to show a wide-ranging overview of the game, the effort is to offer a thorough grounding in the all-important opening phase of chess play. Silman, a top U.S. chess player, takes the chess student through all of the major opening lines for both the white and black pieces.

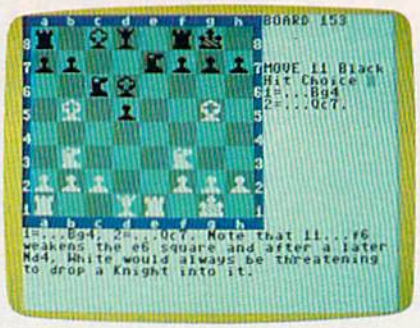
The package comes with three disks for the 64: The first disk has the main guide program on one side and the *Coffeehouse Chess Monster* on the other; the second and third disks contain the openings and their explanations for white and black pieces, respectively, on both sides of the disks. Also included in the package are two fold-out 17 × 22 inch roadmaps that show how the tutorials progress from move to move, branching as different variations crop up. The maps serve not only to let you know where in a tutorial you are, but also to see how to quickly jump from one part of the database to another without backing up board by board.

In the tutorials, you're presented with a two-dimensional game board that takes up about two-thirds of the screen. Standard algebraic notation is used, such as N x e4 (Knight captures the piece on File e at Rank 4). The rest of the screen presents text explanations of what is going on and the variety of options and where they lead. Also presented are different ways to move through the tutorial, helpful hints for using the program, and a method for changing the view of the board.

These packages are highly recommended as an excellent resource for chess players at all levels of play.

For example, pressing the right cursor arrow moves you forward in the tutorial by one board; pressing the cursor down arrow moves you back one board; pressing the X key flips the board onscreen to show the other player's point of view; and pressing the plus key moves the program to what's called Express Depots—points from which you can jump to any board on the disk just by typing its number.

As you move through various openings and defenses, you'll find the accompanying explanations succinct and clear. The available options may at first seem bewildering in their number, but that feeling will diminish as you work with the program. Queen Pawn, English, Bird's, Larsen Attack, Sokolosky's, Ruy Lopez, and many other opening variations are presented. And appropriate defensive maneuvers are covered



Jeremy Silman's Guide To Chess Openings

quite well also. At any time during the tutorials, you can call up the chess program and take over game play to try your own luck against the computer.

Another Enlightenment package available for Commodore 64 chess players is *50 Classic Chess Games*, an annotated collection of 50 of the best chess encounters played during different periods in history. The chess analysis is provided onscreen through comments written by Paul Whitehead, a noted chess player in U.S. and international competition.

Using the same type of road-map foldouts and branching structure in the program, you can step your way through each of these games, picking up pointers about strategy and seeing what makes these games so special.

The 50 games are divided into eight categories, including Old Masters (such as Paul Morphy versus the Duke of Brunswick), the Lasker Era, the Capablanca-Alekhine Era, the Botvinnik Era, the Bobby Fischer Era, Contemporary Soviets, The West Strikes Back, and the Karpov-Kasparov Era.

Each game appears to have been chosen not only for its particular style of play, but also for the valuable lessons that average players can learn by studying.

Both of these games are excellent companions to the original *Paul Whitehead Teaches Chess*, and they can stand on their own as well. Chess instruction is an often neglected aspect of computer chess programs. These packages are highly recommended as an excellent resource for chess players at all levels of play.

—Selby Bateman

Jeremy Silman's Guide To Chess Openings *$59.95*
50 Classic Chess Games *$19.95*
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Maniac Mansion

Whatever happened to teenagers-vs-the-mad-scientist movies?

There used to be lots of them—epics like *I Was A Teenage Frankenstein, Attack of the Puppet People, The Giant Gila Monster,* and *I Was A Teenage Werewolf.* In all of them, a group of teens banded together, usually to rescue one of their number from the clutches of a scientific genius, species *decidedly deranged.*

It's appropriate that Lucasfilm Games—which, through another arm you might have heard of, produced some of the most successful teenage science fantasy movies ever made—has resurrected those old teenagers against the mad scientist plots, updated them, and turned the whole thing into a campy computer game.

Maniac Mansion is the game, but it has a distinct movie feel to it. There's a precredit teaser—a flashback showing a meteor racing across a night sky to crash into the ground near the mansion of Dr. Fred, after which the credits roll, just like in a movie. And at various points during play, the onscreen scene cuts away from you to reveal action going on elsewhere in the evil house. Pop some corn, put some wheels on your computer chair, and you could almost pretend you were at the drive-in.

Like any good mystery manor, Maniac Mansion *is full of doors that must be opened, locks that must be unlocked, secrets that must be revealed.*

Unlike a trip to the movies, though, you're responsible for casting this production yourself, and for playing all of the roles. Our hero, and the central character, is Dave, whose girlfriend, Sandy, has been kidnapped by Dr. Fred. It's up to you to rescue Sandy, but you're going to need some help. *Maniac Mansion* lets you take two of your friends into the house of horrors with you.

Choose from Razor, a female punker; Bernard, a physics whiz with a cowardly streak; Jeff, a surfer; Syd, a rock musician; Michael, a photographer; or Wendy, a would-be novelist. With your team assembled, it's time to swallow your fear and approach the house of horrors.

Like any good mystery manor, *Maniac Mansion* is full of doors that must be opened, locks that must be unlocked, secrets that must be revealed. Using a joystick-controlled interface, you can examine objects, pick them up, and put the tools you gather to work. The interface has a basic but surprisingly comprehensive choice of commands ranging from *walk to* and *pick up* to *turn on, turn off,* and *fix.* There seems to be no limit to the number of things you can carry along with you, and—considering the sorts of challenges you encounter inside the mansion—it's best to pick up anything that looks useful.

The user interface also lets you change your point-of-view character. Simply move the cursor to the New Kid option, and indicate which of the other kids you wish to play. While this feature lets you fan out and explore different levels of the house, there are some challenges that require at least two kids to master. And there are some situations you won't want to face alone.

Because you need more than one person to handle some of the challenges, it would be nice if the interface included a command by which you could order the others to follow you. As it is, you must shift back and forth among the characters, moving them one at a time to the desired location.

Maniac Mansion is a *big* house. Every room seems to lead to other rooms. From the foyer alone you have several choices, including a broad staircase, doors that open, and doors whose opening mechanism must be discovered.

Wandering around the first floor, you find a library, an old Atwater-Kent-style radio that can be turned on to produce convincing static, secret panels, and a deliciously filthy kitchen complete with microwave, working faucet, and chainsaw.

Plaques and messages can be read using the player interface, lights can be turned on and off, suspicious-looking objects can be pushed or pulled to see if they are triggers for hidden compartments or doors.

Upstairs and downstairs, there are even more rooms, staircases, hatchways. In or around almost all of them are objects and lifeforms, including animated meat-eating plants, nuclear reac-

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tors, monster rock-'n'-roll gear, mummies, Victrolas and video games, cassette players and a Ham radio, clocks, lamps, and gravy stains.

The degree of detail in this game is exceptional. There are more than 400 items to be acted upon throughout the house. Many of the challenges you face require the bringing together of different things, from various rooms. Even if the contents don't seem to figure in the game, it's fun to poke around in cabinets or peep behind curtains. There's plenty of laughter hidden among the chills of *Maniac Mansion*.

The animation and graphics are likewise superb. Each of the teenagers is fully realized, with features and wardrobe that are wholly in character. The trappings and appointments of the rooms are colorful and convincing. The rooms and the objects they contain have a realistic three-dimensional look to them (considering the number of hidden compartments and secret rooms, four-dimensional might be more appropriate).

Cutting from scene to scene is an important part of any movie, and it's an important part of *Maniac Mansion* as well. At various, unexpected points in the action, the screen cuts away from you to present a scene over which you have no control, but which contributes information or urgency to your play. Some of the cuts show the evil scientist threatening the lovely Sandy—he has a machine that may soon be removing her brain. Then there's the deranged Ed, who gets hungry or decides to answer the door at the most unfortunate of times. If you pay attention to the cuts, you can sometimes hide from Ed—otherwise, it's off to the supposedly escape-proof dungeon.

And even if you escape Ed, there's the evil Nurse Edna, equally committed to keeping the dungeon populated. Underlying all of the madness is that evil meteor from the teaser. Allusions to it can be found in various artifacts throughout the house. The meteor also comes up in dialogue during some of the cuts.

Among the lingering effects of the malevolent meteor is a voraciously hungry but more-than-slightly adorable green tentacle which stands guard over still more rooms. Feed the tentacle, and you are allowed to pass. Should you encounter the tentacle again, you might learn something of its unhappy life. (The tentacle has a dreadful purple cousin eager to attack Sandy, one scene reveals.)

Eventually, if you can avoid capture by Ed, Nurse Edna, or Dr. Fred—still more roles for Anthony Perkins, Ellyn Burstyn, and John Agar—you stand a chance of rescuing Sandy and ending the horror of *Maniac Mansion*.

In fact, there are several successful endings. This is one "movie" that you can attend over and over again, without exhausting its possibilities or wealth of detail. *Maniac Mansion* is a house full of fun, and a superb substitute for those movies where a handful of teenagers are all that stand between a scientist and world domination (or at least conquest of the local malt shop crowd).

—*Keith Ferrell*

Lucasfilm Games
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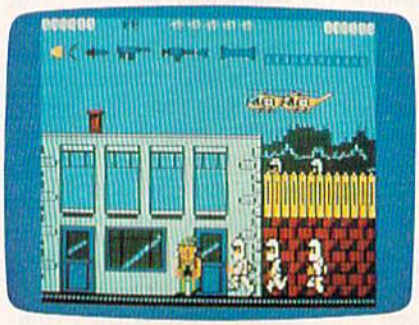
$34.95

Three Action Games For The 64

If arcade-style sound and graphics are your preference, but pumping tokens into machines is not, you should look into *Sanxion*, *Delta Patrol*, and *Bazooka Bill*. *Sanxion* and *Delta Patrol* are marketed by Electronic Arts (as part of its new low-cost product line, Amazing Software) and *Bazooka Bill* is available from Spinnaker.

Bazooka Bill

Cartoon-style violence abounds in *Bazooka Bill*, so it probably isn't the best game to buy for impressionable youngsters, which is a shame because its music and animation would be sure hits with the Saturday morning TV crowd. It's the most cartoonish of the three games reviewed here and (since Bazooka Bill's life can be extended indefinitely) the easiest for a beginning player.



Bazooka Bill finds himself in a modern-day battle of the Philippines, single-handedly taking on rebel forces in an attempt to rescue General MacArthur. Of course, as with any action game, the premise can be as thin as air—it's the action that's important. And there's plenty of action as impatient, square-jawed Bazooka Bill battles his way to the airport through crowds of machine-gun toting Marines.

The action takes place on three levels. Bill can move forward on two levels, dashing up and down ladders and stairways to avoid threats and to make progress from scenario to scenario. The third level, analogous to rooftops and bluffs, is where Bill can shoot down helicopters and collect the odd cast-off weapons to add to his arsenal.

When the enemy forces quit coming, it's a sure sign that you're running in circles. To make headway, you have to go up and down ladders. Be careful, though—as tough as Bill is, he can lose a life from a simple fall.

When he runs out of lives, a counter appears on the screen. If you can hit the F5 key before five seconds have passed, Bill will be returned in fighting trim, though your score will be zeroed out.

The scenes are cartoon-realistic, comprising barracks, cities and towns, jungle, veld, and airports. When Bill steals a jet by climbing on board, he levitates briefly and gives a *V* sign for victory before taking off for the next island. While in the air, he may shoot down jets and helicopters at will. The risk is approximately the same in the air as it is on the ground. In fact, if I were to criticize this game, it would be because nothing seems to come at Bill out of left field. After the first series of ground and air battles, the action is basically the same until MacArthur is rescued.

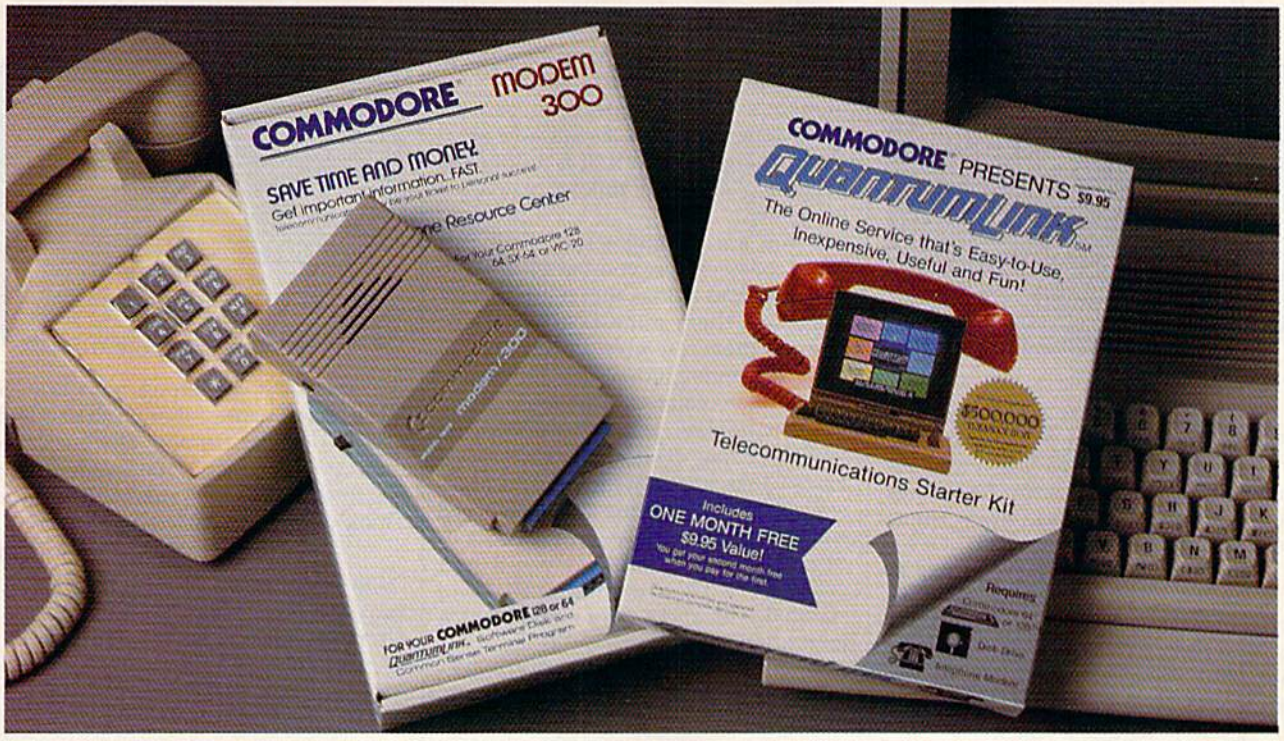
Bazooka Bill is fast-paced (whenever you stop the action by releasing the joystick, Bill petulantly taps the steel toe of his boondocker boot until you start him moving again) and frenzied. The colors and music are outstanding.

If you're an Arnold Schwarzenegger fan, you'll love *Bazooka Bill*.

Sanxion

Chances are that you can correctly guess what the action is like in *Sanxion* just from the name. You are flying a delta-wing fighter through an Earth-like environment, over cities, oceans, deserts, and so on. Your ship and the enemy appear on two screens that give a 3-D aspect to the game. All you have to do is shoot the enemy ships down without being rammed yourself. Nothing could be simpler, right? Except that the sky is full of dodging and ducking enemy ships, and every few seconds a drone comes at you from behind. You have some control over the speed of the game: You can make your ship go faster by pressing to the right on the joystick or make it go slower by pressing to the left, but even at your slowest speed, the pace will leave you breathless.

The colors are fantastic, except at the moment when the landscape changes. For a brief moment everything goes gray; then the white of the ice, the red of the painted desert, the steel and concrete blue-gray of the city all come



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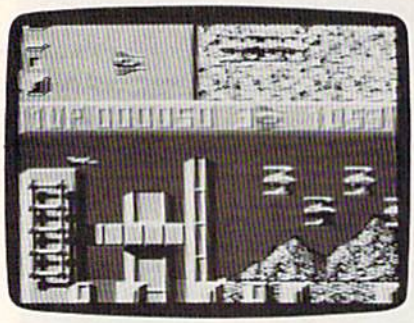


into view.

No music plays while the game is in progress, but when you are knocked from the sky, the dirge-like music begins as a display of the top five scores appears, replaced every few seconds with the game's logo.

Both of the Electronic Arts games are fast and pulse-quickening, with fully orchestrated musical scores and how-the-heck-did-they-do-it animation, but the all-out winner in this threesome is Delta Patrol, or simply Delta, as the logo proclaims.

Delta Patrol

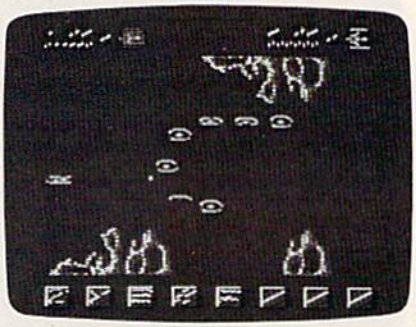
On the surface, *Delta Patrol* is no different from a hundred other outerspace "blast the alien" computer games. What sets it apart is the animation and graphics, which are nothing short of superb.

From the very first screen, your monitor's display appears to become three dimensional, as if stars were actually rushing through it. It is a dramatic beginning, and what follows matches it in quality.

You are piloting a spacecraft that turns constantly as you barrel through obstacles and beings that defy description. Call them mine-laying toroids. Some of them resemble doughnuts that fly in serpentine formations. Others are like rainbow-colored tornadoes.

Accumulate points by destroying without being destroyed; gather powers, such as potent weapons and high-speed engines by flying through special ship enhancements; avoid the rocks of death—a maddening asteroid belt crawling with unnamed uglies and studded with rocks, any one of which might have your name on it.

The secret of a successful videogame is that it keeps you hooked while you fail miserably attempt after attempt, each time getting a little closer to the goal, outwitting the ghost monsters, escaping the maze, or whatever. *Delta Patrol* is a game that will have you playing, failing, and trying again until dawn. (It might as well have been titled *Dawn Patrol*).



You can't go wrong with any of these action games, though the superb quality of *Delta Patrol* is obvious from the very first screen. True arcade action has finally made it to the home screen. Think of all the quarters you'll save.

—Robert Bixby

Delta Patrol
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Bazooka Bill
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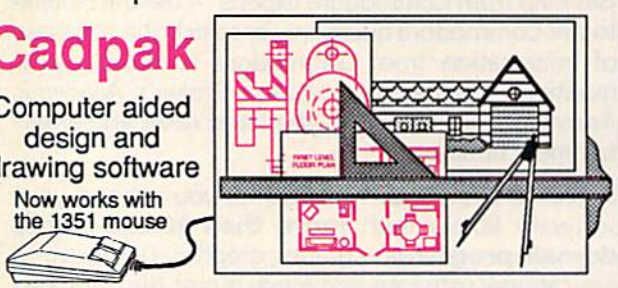

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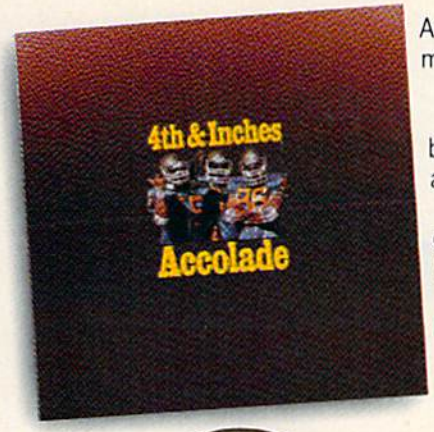

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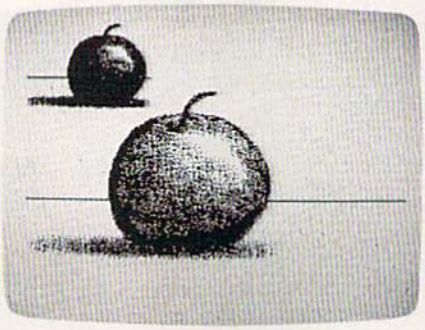
Sketch Pad

Forrest Bentley

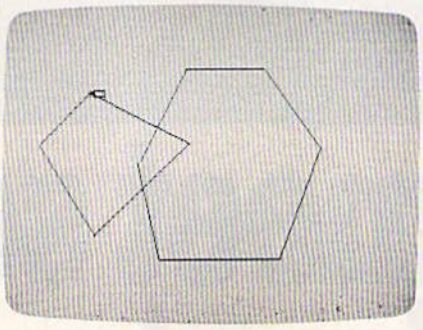
Perhaps the best Commodore 64 drawing program we've ever published, "Sketch Pad" includes many features and extremely fast response. Features such as Fill, Line, Square, Text, and Transfer—a powerful copy-and-paste option—make designing spectacular screens quick and easy. You can save your artwork to disk or print it out on a Commodore 1526 or MPS-802 printer. A joystick and disk drive are required.

"Sketch Pad" is a *fast* drawing program that allows you to create detailed color pictures. Using the 320 × 200 pixel bitmapped screen, Sketch Pad offers the highest resolution possible on the Commodore 64. And Sketch Pad has a wide variety of functions, from Draw mode to Line and Fill options.

Worth noting here is Sketch Pad's unique copy feature, Transfer. With Transfer, any section of the screen can be duplicated, reduced, and even saved to disk for later use. You can not only transfer objects from one section of the screen to another, you can also transfer objects from one complete drawing to another.



In this example, Transfer mode has been used to make a miniaturized duplicate of the apple.



In "Sketch Pad," polygons are easily created using the Line tool.

Typing It In

Sketch Pad is composed of four programs: Program 1, the Sketch Pad main menu; Program 2, which handles all plotting done on the bitmap screen; Program 3, which saves your drawings to disk; and Program 4 for printing your sketches.

Program 1 is written in BASIC, so it is recommended that you use the "Automatic Proofreader" found elsewhere in this issue, to assist you in typing it in. If you do not own a Commodore 1526 or MPS-802 printer, delete the following lines in Program 1: 160, 410, 460, and 1040 through 1120—and do not type in Program 4. Note that the Commodore 1525, MPS-801, and MPS-803 printers are *not* compatible with the 1526. Furthermore, almost all interfaces for non-Commodore printers emulate the 1525, not the 1526, and are, thus, also not compatible with the printing routine in Program 1.

Programs 2, 3, and 4 are each written in machine language and must be entered using "MLX," the machine language entry program found elsewhere in this issue. When you run MLX, answer the prompts as follows for each program:

Program 2

Starting address: **8000**
Ending address: **944F**

Program 3

Starting address: **4650**
Ending address: **4697**

Program 4

Starting address: **C094**
Ending address: **C2DB**

After typing in each program, save a copy to disk. Save Program 1 with the filename SKETCH-PAD MENU, Program 2 with the filename SKETCH-PAD, Program 3 with the filename SAVESKETCH, and Program 4 with the filename PRINTSKETCH, all on the same disk. When run, Sketch Pad looks for the programs with these filenames.

Typing In Multiple Sittings

Program 2 is a very long machine-language program, over 5K in length. If you want to stop typing the listing at some point and resume later, press SHIFT-S and follow the screen prompts. Remember to note the line number of the last line you typed in.

When you are ready to continue typing, load MLX, answer the starting and ending address prompts, then press SHIFT-L. MLX asks for the filename you gave to the partially typed-in program. After the load is complete, press SHIFT-N and tell MLX the line number you stopped at. Now, continue typing as before. When you finish all typing, MLX automatically prompts you to save the program.

Running Sketch Pad

To run Sketch Pad, plug a joystick into port 2, turn on your 64, and enter LOAD "SKETCH-PAD MENU" ,8. After the program is loaded, type RUN and press RETURN. Sketch Pad's main menu appears.

The main menu offers nine options—two selected via the function keys, seven with the joystick:

```
f1   Sketch
f7   Print
     Paint Color
     Background Color
     Save Sketch
     Save Transfer
     Load Sketch
     Load Transfer
     Exit To BASIC
```

To choose an option, simply move the joystick up or down. A selected option appears in reverse video. As noted, the Sketch and Print options are selected by pressing f1 and f7, respectively.

Sketch

Once you press f1, the bitmapped screen appears. Pressing f1 while in this mode returns you to the main menu.

Once in Sketch Pad's bitmapped screen, you'll notice a pen-shaped sprite indicating where you're plotting. The joystick controls the pen. To draw, the pen must be down. The joystick's fire button toggles the pen up and down. So that you know the current orientation of your pen, two dark lines appear within the pen when it's down.

Drawing Tools

Sketch Pad contains many drawing tools for the computer artist. The following describes these tools and how to access and use each of them.

Brushes: Sketch Pad offers a selection of six brushes which produce six different strokes. To select a new brush, press B. A brush indicator in the shape of the current brush appears to the upper left of the pen. Continue to press B until you find the brush you wish to use. If you do not want to see the brush indicator while drawing, press the Commodore key and B simultaneously. To turn the brush indicator back on, press Commodore-B again.

Eraser: If you make a mistake—and we all do—you'll want an eraser. To access the eraser, press E. The eraser end of the pen opens up to indicate that Erase mode is in effect. Now, when the pen is down, you erase points rather than draw them. The eraser uses the current brush shape. To return to Draw mode, press D.

Pen Color: To change the color of your pen, press A. Continue to press A until you find the color you want. This does *not* change the plotting color, just the color of the pen sprite. It's best to choose a pen color that contrasts well with the paint and canvas colors.

Pen Speed: You can speed up and slow down the pen's movement by pressing the plus and minus keys, respectively. Try not to get carried away when increasing your pen's speed—this program can move pretty darn fast.

Lines: This option, a straightedge tool, lets you draw accurate, straight lines.

To draw a line, press L. A plus sign (+) appears on the screen at the location of your pen. The plus sign specifies where the line will start. Now, move your pen to where you want the line to end and press the fire button. Instantly, a line is drawn using the current brush.

After the line is drawn, the plus sign moves to the current pen position (the line's endpoint), ready for another line. By allowing you to draw connecting lines like this, triangles, rectangles, and other polygons are easily created.

While in line mode, you may change your mind as to where the start of the line should be. To do this, simply press L again and the plus sign will exchange places with the pen. To exit line mode, press any key other than L.

Rays: Pressing R enters ray mode. Rays works the same as lines, with one exception. After you have drawn a line, the plus sign remains where it was before the line was drawn.

Square: To draw a square, press S. Four plus signs appear, indicating the shape and size of the square. Move the joystick right or left to increase or decrease the horizontal length of the square. Similarly, move the joystick up or down to increase or decrease the vertical height of the square. Once you have the shape you want, press the fire button. Now, move the square to where you want it and press the fire button again. The square is placed onto the screen. Unlike Lines, however, squares are always drawn using the smallest brush. To escape from this mode, press any key.

Fill: To fill an enclosed area on your sketch, move the pen inside the area and press F. Make sure that there aren't any cracks in the edges or your paint will leak out. To terminate a Fill before it is finished, press any key.

Text: With this tool, you can draw text in 15 different sizes. To place text onto a sketch, press T. The pen changes to an underline cursor. Now, simply type in your message. The cursor keys and the RETURN key can be used to move the cursor around the screen. The f1 key exits Text mode.

To erase a character while entering text, press f3. The cursor splits in two, indicating that you're in Erase mode. Now, use the cursor keys to move on top of the incorrect letter and retype that same letter. Just as with correctable ribbon on a typewriter, the offending letter is lifted from the screen. Press f3 again to draw characters.

Toggling the text cursor between Draw and Erase is identical to setting the pen to Draw and Erase. For instance, if you wish to enter reverse letters on a solid object, type your letters in Erase mode.

To increase the size of your characters, press the up-arrow key (↑, not the cursor up key). Each time you press this key, the character size increases. The left-arrow key (←) reduces the character size.

Transfer: This option supplies three important tools: a photocopier, scissors, and paste. You can select an area of the screen, copy it, and then paste the copy—normal sized or reduced—anywhere on your sketch.

To begin the transfer, move the pen to the upper left corner of the area that you wish to select and press X. As with the square tool, four plus signs appear. Move the plus signs with the joystick to form a square that encloses the area to be transferred. Press the fire button and the enclosed area is copied. Now, move to where you want the copy to be placed and press the fire button again. The copy is pasted onto the sketch.

Sketch Pad Quick Reference Chart

Key	Function
f1	Move between Sketch mode and main menu
B	Change brush
Commodore key-B	Turn on/off brush indicator
E	Erase
D	Draw
A	Change pen color
+	Increase pen speed
−	Decrease pen speed
L	Line
R	Rays
S	Squares
F	Fill
T	Text
↑	Increase text size
←	Decrease text size
f3	Text erase (on/off)
X	Transfer
M	Retransfer (miniaturized)
N	Retransfer (normal size)
C	Clear (press twice)
O	Oops (press twice)

After you're through making all the copies you want, press any key and the pen will reappear. If you want to retransfer the same copy later, just press N. The selection square reappears. Move to where you want the copy placed and press the fire button.

If you want a miniaturized copy of the transfer, press M. The selection square reappears. Move to where you want the miniaturized copy placed and press the fire button. A copy that is one fourth the size of the original will be drawn. Hint: To show detail on a small object, draw the object large and miniaturize it later.

To transfer a copy to another sketch, press X, select an area, press RETURN to exit Transfer mode, go back to the main menu, load a new drawing, enter sketch mode, and press N or M to transfer the copy. Transfers may also be saved to disk for later use (see below).

Clear: The garbage can is probably an artist's most important tool. Everyone needs to throw away their work once in a while. The clear option gives you this ability by disposing of your current sketch and starting you out with a clean slate. You may also wish to use the Clear option to begin a new drawing after saving the current one to disk.

To clear a sketch, press C. The pen vanishes, acknowledging your keypress. If you really wish to toss your sketch into the garbage can, press C again and the screen will clear. If you change your mind, press any key other than C and the pen will return, leaving your drawing intact.

Oops: Here you can dig through your garbage and pull out an old version of your drawing. The Oops option restores your drawing back to the way it was when you entered Sketch mode from the main menu. To enter Oops mode, press O. The pen will vanish. Press O again to restore the sketch. Pressing any other key aborts the Oops process.

To protect a sketch after several modifications, exit to the main menu and then re-enter Sketch mode. This way, you'll always have a good sketch to Oops back to. Remember, to move between Sketch mode and the main menu, press f1.

Now, back to the menu options.

Print

If you own a Commodore 1526 or MPS-802 printer, pressing f7 prints the current sketch. You have two print sizes to choose from: large and small.

Paint Color

Just to the right of this option is a color bar. An arrow points to the current paint color. By moving the joystick left and right, you can move the arrow and change the paint color.

Background Color

Like the paint color, a color bar with an arrow selects the current background color. Moving the joystick left or right allows you to select a new background color.

Save Sketch

To save your sketch, simply select this option with the joystick and press the fire button. The program prompts you for a filename. When saved, the characters SP. are added to the beginning of the filename to help you remember which files are Sketch Pad files. Pressing RETURN without entering a filename returns you to the main menu.

Save Transfer

This option allows you to save a transfer. A transfer is a selected portion of your sketch (see Transfer description above). To save a transfer, move to this option and press the fire button. The program prompts you for a filename. Transfer files are saved with the letters SX. added to the beginning of the filename. You may exit this option by pressing RETURN without entering a filename.

Load Sketch

Here you can load a previously saved sketch. Move to this option and press the fire button. When the program prompts you, enter the filename that you used to save the sketch (without the added SP.). The sketch is loaded and ready for editing and/or printing. Pressing RETURN without entering a filename returns you to the main menu.

Load Transfer

This option allows you to load a previously saved transfer. To load a transfer, move to this option and press the fire button. When the program prompts you, enter the filename that you used to save the sketch (without the added SX.). The transfer is loaded and ready for use. You may exit this option by pressing RETURN without entering a filename.

Exit To BASIC

To exit the program, select this option. The program asks if you are sure. Enter Y if you are. Any other entry returns you to Sketch Pad's main menu.

See program listings on page 88.

The time: 1400 hours. Somewhere in the Pacific. Some ill-fated coordinates in World War II.

Damage Control reports a hit on the starboard side. Send in Alpha, Baker and Charlie to repair.

eyeball to eyeball action. This time around you'll be right in the middle of it all. You knew it wouldn't be pretty. But how tough could it be to rescue a downed pilot?

Will it be the twin 40mm Bofors anti-aircraft guns? Or the 5" lead-spewers aft? Depth charges or torpedoes? Autopilot or guts?

LIFE, LIBERTY AND THE HAPPINESS OF PURSUIT.

Radar spots inbound Zeroes. Ready forward gunnery positions. Man the anti-aircraft turrets. They're coming.

You're at the helm, commanding the greatest concentration of firepower ever put in a lightweight fighter. The deadly Fletcher Class Destroyer.

You've embarked on the first simulation that actually combines the intricate, large-scale strategy of wargaming with the intensity of furious,

It sure seemed a lot easier than shelling islands, escorting a convoy or hunting subs.

Or so you thought. But now look what you've got. Thirteen fully-operational, ear-bursting battle stations to worry about, all armed to the gills. Not to mention radar. Navigation. Sonar.

And half the Japanese fleet crawling up your spine.

Time to make some tactical decisions.

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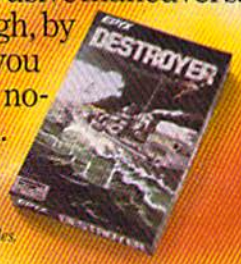
Any choice could be your last, so make it good.

Suddenly, you hear the ominous rumble of incoming Zeroes. You fire, and send one plummeting to the sea, trailing a plume of smoke.

On instinct, you instruct the bridge to commence evasive maneuvers.

Even though, by experience, you know there's nowhere to run.



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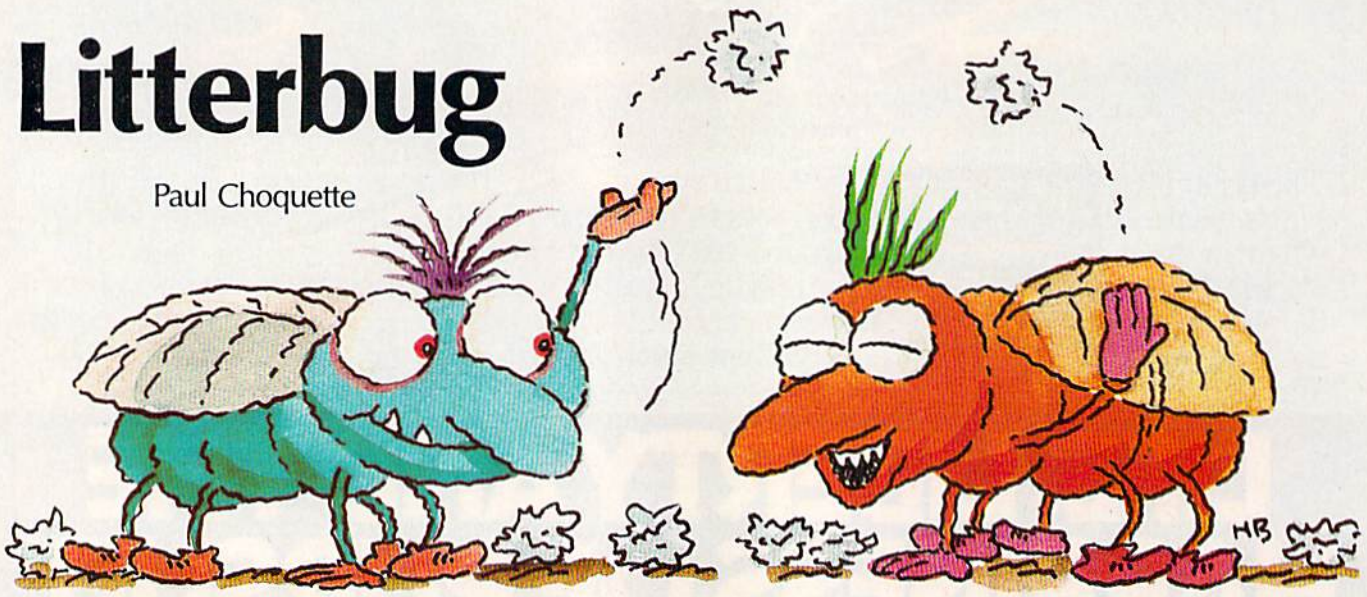
Litterbug

Paul Choquette



Collect the trash left by aggressive garbage-loving insects in this fast-paced arcade game for the 64. Waste disposal was never this exciting. A joystick and disk drive are required.

It's your first day on the job and you're already considering retirement. Being the city's chief sanitation officer sounded great at first—prestige, a fancy uniform, and even your own official waste receptacle—but no one told you about the bugs. It seems that the city has been infested with a rare breed of giant insects: litterbugs, to be exact. Every time you begin collecting trash, these litterbugs attack, chasing you throughout the city. Talk about an insect problem.

Now, in a high-risk occupation such as litter control, you're bound to run into some trouble now and then. These bugs play dirty: Not only do they litter the streets—if they catch you picking up their trash, they'll soil your uniform. And no self-respecting sanitation officer would be caught dead in a soiled uniform. So, everytime a litterbug catches you, you must go back to headquarters, change your uniform, and return to duty. It's a dirty job, but somebody's got to do it.

Getting Started

To play "Litterbug," you must first type in and save Programs 1, 2, 3, and 4. Program 1 is a very short BASIC program. Programs 2, 3, and 4 are each written in machine language and must be entered using "MLX," the machine language entry program found elsewhere in this issue. When you run MLX, answer the prompts as follows for each program:

Program 2

Starting address: **$C021**
Ending address: **$CEC8**

Program 3

Starting address: **$0340**
Ending address: **$03FF**

Program 4

Starting address: **$09C0**
Ending address: **$0FBF**

After typing in each program, save a copy of each one to the same disk. Save Program 1 with the filename LITTERBUG BOOT, Program 2 with the filename LITTERBUG, Program 3 with the filename LB1, and Program 4 with the filename LB2. When run, Litterbug looks for the programs with these filenames.

To run Litterbug, plug a joystick into port 2, turn on your 64, and then load and run the file LITTERBUG BOOT. A title screen appears. Pressing f1 from this screen changes the speed of the game. The speed can vary between 1 (slow) and 9 (very fast).

Pick up trash and avoid the nasty litterbugs in this unusual arcade-style game. In the photo above, the player has just dropped a decoy to distract the bugs.

Press the joystick's fire button to start the game. A screen littered with trash (little white dots) appears. You are located in the center of the screen, with a litterbug above and below you. The object of the game is to clear the screen of trash while avoiding the litterbugs.

To begin, move the joystick in any direction except diagonally. The moment you make your first move, the litterbugs start chasing you.

Armed with your trusty wastebasket, you pick up litter by running on top of it. Once you've cleared the screen of trash, you move to the next level. Each level is more difficult, with more and faster litterbugs.

If a litterbug catches you—soiling your clothes—you must change

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Enter Text
Arrows = move Esc = quit
To change options press.
Ctrl-A Alignment = Centered
Ctrl-S Text Size = Normal
Ctrl-T Texture = Standard
Ctrl-F Text Font = Office

10:03 — *Craft your message from 9 expressive typefaces in upper and lower case.*

10:04 — *And preview again.*

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into a whole new uniform. You begin the game with four uniforms. You receive one extra uniform when you reach level 5. The game ends when you've used up all your uniforms.

Litterbug Decoys

To aid in your trash collection, the city provides you with *litterbug decoys*. Litterbug decoys are ingenious devices that appeal to the object of every litterbug's most basic desire: garbage.

To use a decoy, you must drop it by stopping all movement and pressing the fire button. When dropped, a litterbug decoy looks just like a large piece of trash. Mesmerized by the sight of such an impressive piece of garbage, the litterbugs stop chasing you in order to investigate the decoy. Once touched by a litterbug, however, litterbug decoys instantly vanish. No longer under the decoy's fraudulent allure, the litterbugs resume chasing you.

Note that in level 2 and up, there are three litterbugs chasing you. When a Litterbug Decoy is dropped, only two of the litterbugs move toward the decoy. The other continues its pursuit of you.

Each uniform (life) contains eight litterbug decoys. Use them sparingly—you might need one to get out of a tight situation.

Every once in a while, a flashing litterbug decoy appears on the screen. By touching the flashing decoy, one or two decoys are added to your inventory. You can carry a maximum of eight decoys.

Scoring

You get 10 points for each piece of trash collected in levels 1 through 4, and 100 points in levels 5 and up. When using a litterbug decoy, you get 100 points for each piece of trash collected in levels 1 through 4, and 1000 points in levels 5 and up. Each time you add a decoy to your inventory, you receive 1000 points.

The score is displayed on the screen at all times, along with the high score and number of uniforms remaining. To freeze the game, hold down the SHIFT key or press SHIFT LOCK. To resume play, release the SHIFT key or press the SHIFT LOCK key again.

See program listings on page 93.

All programs listed in this magazine are available on the GAZETTE Disk. See details elsewhere in this issue.

Super Disk Utilities

The ultimate utilities disk for the C128 & 1571. Included among its many features are:

- Two drive copy program for the 1571
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- CP/M Plus disk editor
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- Erase a track or bulk erase a disk
- Most utilities also work on 1541
- And much, much more!

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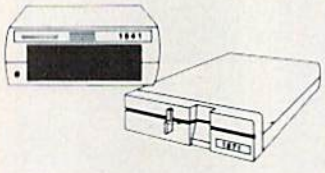

1541/1571 Drive Alignment

1541/1571 Drive Alignment reports the alignment condition of the disk drive as you perform adjustments. On screen help is available while the program is running. Includes features for speed adjustment and stop adjustment. Complete instruction manual on aligning both 1541 and 1571 drives. Even includes instructions on how to load alignment program when nothing else will load! Works on the C64, SX64, C128 in either 64 or 128 mode, 1541, 1571 in either 1541 or 1571 mode! Autoboots to all modes. Second drive fully supported. Program disk, calibration disk and instruction manual only **$34.95!**

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MicroProse has broken new ground with **AIRBORNE RANGER**, the quality action game where tactical thinking and lightning reflexes determine your fate. Your missions will vary as much as the climate and terrain. Slip silently into position to rescue prisoners trapped in "tiger pits" from a P.O.W. camp, or throw caution to the wind and try to destroy a key munitions dump in the desert. But watch out . . . enemy troops can attack from any direction.

The action is fierce as you control one soldier's battle against overwhelming odds. You'll need skill and strategy to outmaneuver your enemy, plus courage and some luck to make your escape. Along the way, search out that hidden cache of weapons and first aid supplies . . . you'll probably need them.

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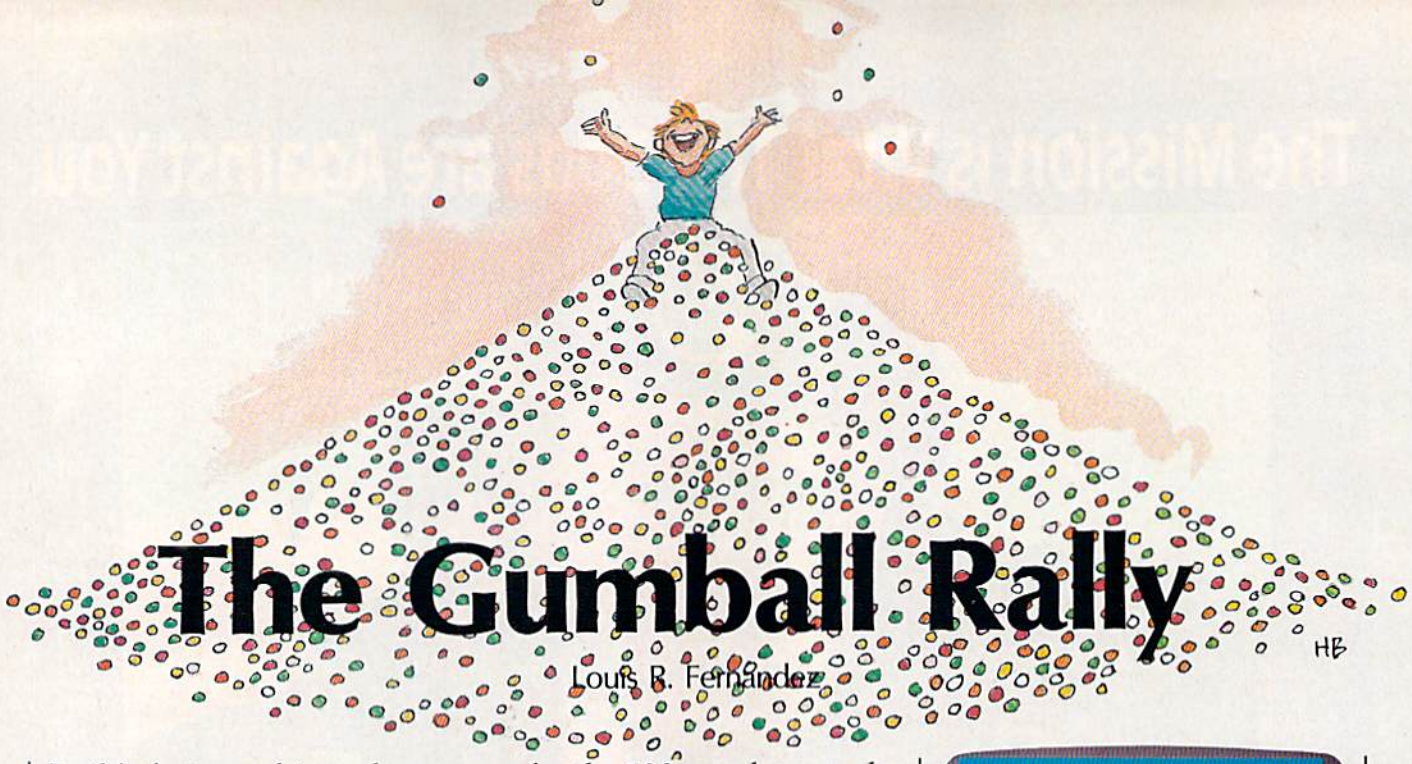


The Gumball Rally

Louis R. Fernandez

In this fast-paced two-player game for the 128, you have to do some quick thinking. If you can add and subtract quickly—without using a calculator—you'll have a definite advantage. Two joysticks are required.

It's not exactly Wall Street, but the game of "Gumball Rally" does give you a chance to make a fortune in the volatile gumball market. Your goal is to make more money than your opponent by acting quickly to buy gumballs at the right price. You can't buy and sell wildly, however. The ability to make quick calculations in your head is a strategic asset.

The rules of Gumball Rally are simple enough for a child who's learning to count money. So, although it's primarily an action game, it has some educational value.

There are no special typing instructions, except to mention that the game was written in BASIC 7.0, and that it must be typed in and run on a 128 in 128 mode. Also, use the "Automatic Proofreader," listed elsewhere in this issue, to be sure that you don't make any typing mistakes. After entering the program, DSAVE a copy before proceeding. When you've finished typing it, plug in two joysticks, and you're ready to play.

Three Maneuvers

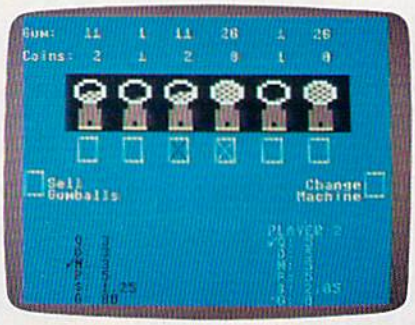
At the beginning of the game, you'll see six gumball machines. Each contains exactly 26 pieces of penny gum. Whenever its supply of gumballs is depleted, a machine is automatically refilled with 26 new pieces of gum. Also, each machine can hold a maximum of ten coins.

The two players start the game with $2.05 in their pockets. This cash is divided into five quarters, five dimes, five nickels, and five pennies.

In the high-stakes world of gumball finance, you can indulge in three types of transactions: buying, selling, and making change. To buy gum, move your player—via joystick—to a gumball machine and insert a coin. If the coin is a quarter, you'll get 25 gumballs. If it's a dime, you'll get 10, and so on.

To walk back and forth, move the joystick left and right. Move the joystick up and down to select which coin you want to spend. Quarters, dimes, nickels, and pennies are marked Q, D, N, and P on the bottom portion of the screen. When you've chosen a machine and a coin, press the fire button to drop the coin in the machine. While you're standing in front of a machine, your opponent will politely avoid it. You can buy as many gumballs as you want while you have control of a machine.

Once in a while, you'll try to buy some gum, but nothing will happen. If you've spent all your dimes, you obviously have no dimes available. In this situation, you might want to use another coin. Also, each gumball machine holds a maximum of ten coins. If the coinbox is full, the machine won't sell you any more gum, even if there are gumballs left in the glass bulb.



Quick thinking and sound strategy are the keys to success in this fast-action two-player economic simulation game.

Above each gumball dispenser you'll notice two numbers. One tells you how many coins are in the machine, up to the maximum of ten. The other tells you how many gumballs remain (1–26).

Watch the pieces of gum carefully. If a machine holds 26 gumballs and you spend a nickel and a dime, the number will drop to 11. At this point, you're allowed to drop in a quarter, but you'll receive only the 11 pieces of penny gum that are in the machine. You'll suffer a net loss of 14 hard-earned pennies, which is not a savvy business move.

When you start running low on certain coins, you can sell your stock of gum or make change.

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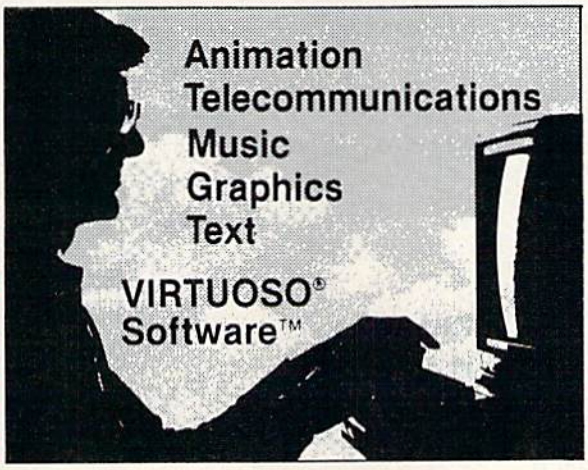

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Program Structure

Line Number	Description
10–60	initialization
70–420	sprite data
430–450	build common sprite data
460–510	variable initialization
520–540	music data, voice initialization
550–580	save sprite data to array GB$
590–710	set up screen
720–830	play music while waiting for start of game
840–890	read joysticks
900–940	change selected coin
950–1070	move player sprite to different machines
1080–1100	decode pressed fire button
1110–1180	take gumballs; compute new totals; check if all machines have MC (see variables below) coins
1190–1260	sell gumballs
1270–1320	change machine
1330–1460	end of game

Variables

C(2)	score for each player
CC(6)	coin count in each machine
CG(2)	current gumball machine 1–6: gumball machines 7: sell gumballs 8: change machine
CS(2)	currently selected coin (1=Q, 2=D,3=N,4=P)
CV(4)	coin values (25, 10, 5, 1)
G(2)	number of gumballs currently held by each player
GB$(26)	gumball machine sprite data
GC(6)	gumball count in each machine
MC	maximum coins in each machine (maximum is ten)
P	current player
Q(4,2)	number of coins (1–4) for each player (1–2)
SP(8,2)	sprite coordination data
T(2)	total money for each player
TG(2)	grand total of gumballs for each player

Move your character all the way to the left to sell the gum you currently hold. You get one cent per gumball, payable in the largest coins possible. For example, if you visit five gumball machines and spend a dime in each one, your supply of dimes drops to zero and your supply of gumballs increases to 50. If you now sell your gum, you're paid 50 cents, but you receive two quarters (not the five dimes you spent).

Since you get paid off with large coins, you'll probably start running out of nickels and pennies as the game progresses. To rectify this situation, move to the change machine found to the right of the six gumball machines. Move the joystick up and down to select a coin, then press the fire button. You can get change for quarters, dimes, or nickels.

The game ends when all six gumball machines have been filled with ten coins. The player with the most points wins. The final score is a combination of three values: left-over money, gumballs on hand, and total number of gumballs bought from the machines.

See program listing on page 96.

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Are you thinking of buying a multi-function cartridge? Well, don't make a FINAL decision until you look at this comparison chart.

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Is the cartridge itself designed to be easily upgradeable?	Y	N
Features both pre-programmed and user-definable function keys?	Y	N
Will it print both multi-color and standard bit mapped screen dumps?	Y	N
How many different sizes can the screen dumps be printed at?	3	1
Save graphic screens to disk in either Koala™ or Doodle™ formats?	Y	N
Menu driven with easy to read, full screen windows?	Y	N
Features both a fast loader and a fast disk formating option?	Y	N
C-64™/1581 fast load support (20+ blocks/sec.)	Y	N
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Holding A High-Tech Yard Sale

Fred D'Ignazio
Associate Editor

Are you a computer pack rat? Do you save dozens of old disks with who-knows-what stored on them? Hoarded away somewhere in your basement, do you still have your first computer printer? Or some tape cassettes that ran on the old TRS-80 Model I, or the Coleco Adam, or the Commodore PET? How about crinkled up wires and cables? Old circuit cards? Stacks of cryptic, outdated manuals? Ancient computer magazines? And even—yes, I'll say it—*obsolete computers?*

If you answered yes to many of these questions, it's time you held your first high-tech yard sale.

Last weekend, my family and I held a yard sale in which we featured a host of high-tech items: prehistoric adventure games, educational software that my kids had outgrown, boxes and boxes of old manuals, programs for computers we no longer own, and hundreds of miscellaneous wires, cables, converters, and whatnot. We had never held a yard sale before, so we talked to friends who had held yard sales—and survived. Based on our friends' advice, we publicized the yard sale everywhere we could think of:

- We called the local paper and put a zippy ad in the classifieds.
- We used our Commodore 128 and printed up flyers.
- We went to the local hardware store and bought poster board and stakes and made our own signs.
- We signed onto the local electronic bulletin boards and placed online yard-sale ads. (This technique was wildly successful. Hackers who saw our ads on the boards called other hackers, and news of our sale spread like wildfire.)
- We called local computer stores, and they gave us the phone numbers of local computer user groups. (One computer store donated hundreds of plastic bags that our customers used to carry away their loot.)

We borrowed cafeteria tables from my children's school and picnic tables from neighbors, and we set up everything under our carport and out on our patio. Once we carted everything outdoors and placed items out on the tables, it looked awesome. (I felt like a Computer-Land Czar.)

The Price Is Right?

My wife and I went around and attached little price stickers on everything. I had no idea how to price lots of the items, so we decided to have interested customers come up to me and ask for a price. This turned out to be a great idea—I learned that half the fun of a yard sale is dickering and bartering. Also, it let me turn the yard sale into a "Gambler's Sale." The first day of the sale, everything was full price. After that, the prices came down lower and lower until, on the last hour of the last day, they fell to zero.

Our yard sale lasted from the Wednesday of one week to the following Monday. We advertised the hours of the sale to be from 10 a.m. to 6 p.m., but that was a joke. Our first customers each morning showed up before 7 a.m., and sometimes we had to turn our carport lights off at night because people were still browsing at 11:00.

By the last hour of the last day, there was not much left. But there were still 14 or 15 people busy picking through the high-tech remnants. That's when I had a brainstorm. I lined up everyone at the edge of the carport and had my teenage assistants stick number tags on people's shirts. The first person who had arrived received #1, the second person #2, and so on. Then, right at the moment the yard sale ended, we began turning people loose to get goodies at 10-second intervals. Each person was allowed to pick out two items *for free*. Then they had to rush back to the edge of the carport. Unless you've watched a TV game show or grocery-store sweepstakes, you've never seen anything like it! You would have thought we were at Fort Knox. Six-year-olds and sixty-year-olds whizzed through our carport snatching up old disks, cables, and magazines, and then ran back to their starting place. Everyone got into the spirit. And when it was all over, nothing was left.

That night my family and I sent out for Chinese food. We ate happily, then we collapsed. Our yard sale had been successful, but for six days we had lived life in a fishbowl. Hundreds of people trooped across our lawn and through our house. They made offers to buy our beds, my grandmother's spinning wheel, and Eric's tent. (The yard-sale spirit turns people into maniacs. Once they start buying they don't want to stop.)

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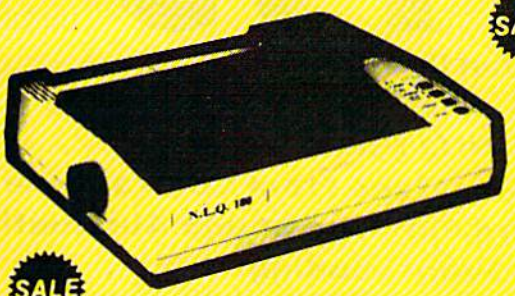

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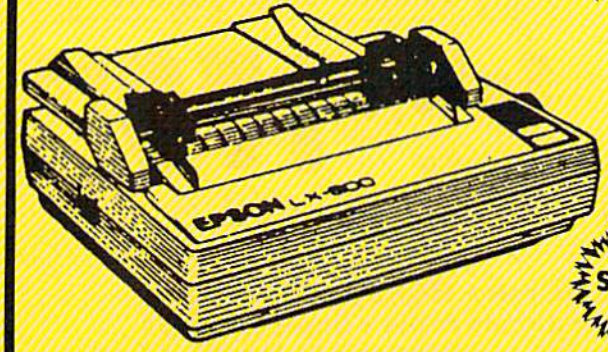

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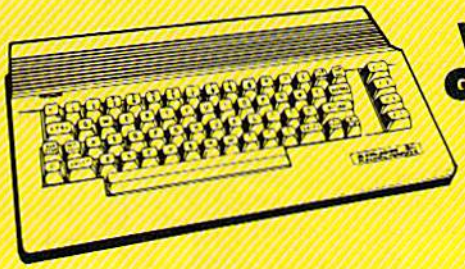

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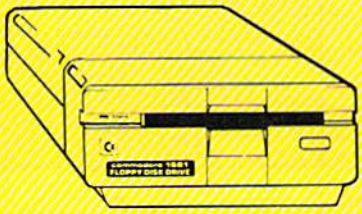

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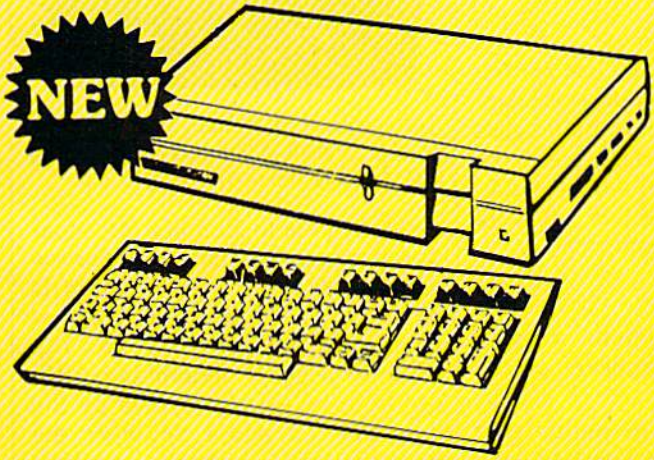

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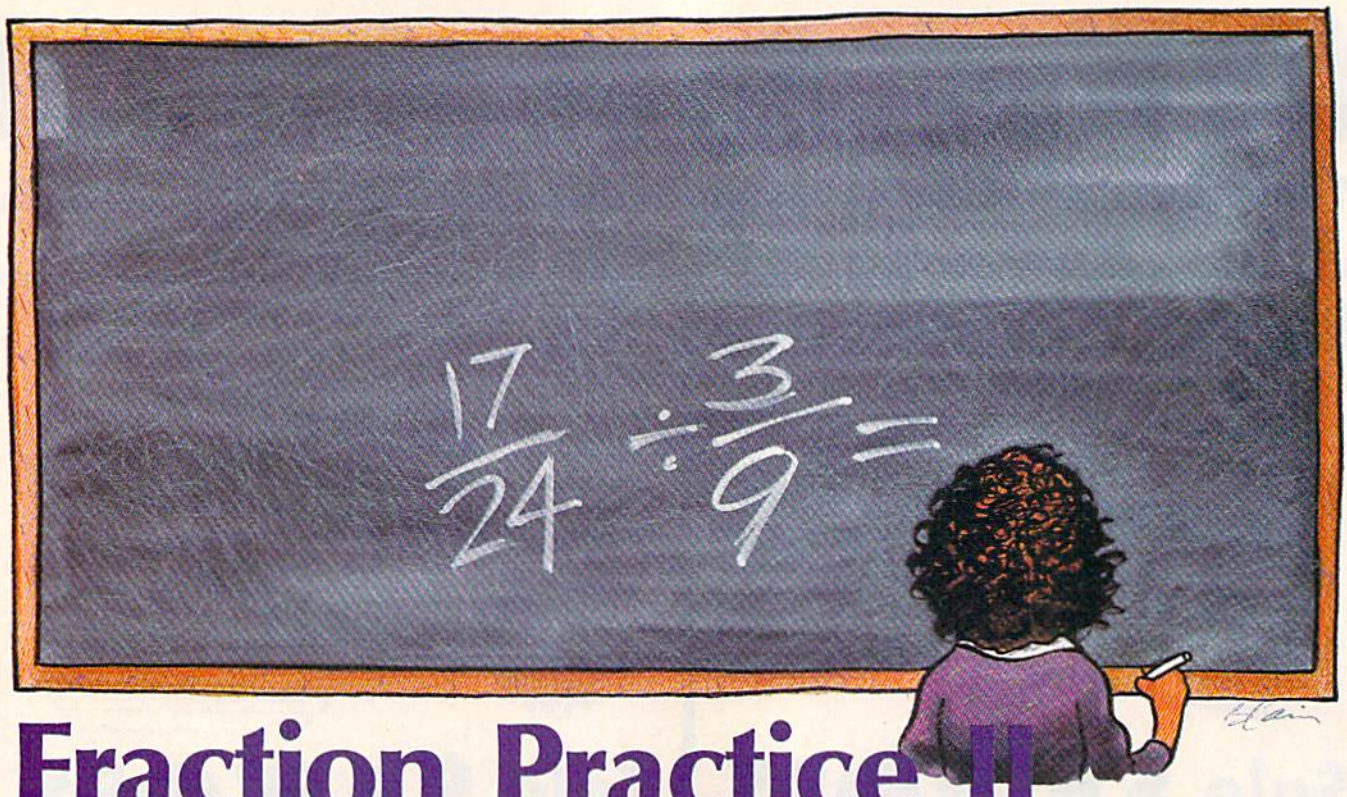


Fraction Practice II

David L. Pawlicki

Dealing with fractions is one of the more conceptually difficult areas of math for young students—especially fraction multiplication and division. Here we present a follow-up to "Fraction Practice," a June 1987 program that focused on addition and subtraction."Fraction Practice II" offers help in fraction multiplication and division by guiding the student through each step. For the Commodore 128, 64, Plus/4, and 16.

Learning to multiply and divide fractions takes practice. From finding a common factor to simplifying the final answer, each step in the process must be understood and memorized. With enough practice using a variety of examples, however, this procedure can become second nature.

"Fraction Practice II" generates 20 random problems in fraction multiplication and division. By taking you through each problem step by step, and pointing out any mistakes that you make, Fraction Practice II becomes a very useful learning tool.

Getting Started

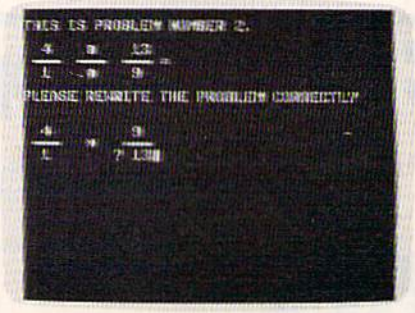
Fraction Practice II is written entirely in BASIC and runs on the Commodore 128, 64, Plus/4, and 16. To get started, type in and save the program. Be sure to use the "Automatic Proofreader" listed elsewhere in this issue to insure that you don't make any typing mistakes.

When you run Fraction Practice II, a title screen appears. Next, the computer asks if you would like to practice multiplication or division. Select the option of your choice.

Multiplication

Upon selecting this option, a multiplication problem appears at the top of the screen.

The first step in multiplying fractions is to try and simplify the equation. (If you skip this step, you'll be required to simplify your answer later.) Look at the top numbers in the fractions (the numerators) and the bottom numbers in the fractions (the denominators). See if you can find a numerator and denominator with a common factor—a number that divides evenly into two or more numbers—other than 1. If you find a common factor, you'll be able to simplify the equation prior to multiplication. For example, let's say our problem is 8/9 × 7/12. Notice that the first fraction's numerator (8) and the second fraction's denominator (12) can both be evenly divided by the numbers 1, 2, and 4. So, when the program asks which two numbers can be simplified, answer 8 and 12.



The computer takes math students step-by-step through the process of multiplying and dividing fractions.

Next, the computer asks for the largest common factor. Although there is more than one common factor, the program accepts only the largest. Answer by entering 4. The next step is to reduce the equation by dividing both the numerator and denominator by 4. Our equation now becomes 2/9 × 7/3. By extracting a common factor from the

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equation, you simplify the multiplication process.

When there are no numerators and denominators with common factors, input a 1.

Now it's time to perform the actual multiplication. Multiply the numerators together first, followed by the denominators. The computer informs you if your arithmetic is incorrect. By successfully multiplying the numerators and denominators together, you have successfully multiplied the two fractions. If the answer can be reduced, the program asks for a reduction. If it can be stated as a mixed number (like 2-3/5), the program asks for a mixed number. After you complete 20 problems, you may choose to begin another set.

If at any time you enter something that causes a REDO FROM START error, you can enter E: to return to the start of the problem.

Division

The first step in dividing fractions is to rewrite the equation as a multiplication problem. To rewrite the division problem, the computer requires you to reenter the first fraction in its original form, replace the oversized division sign with a multiplication sign (*), and then enter the reciprocal of the second fraction. To find the reciprocal of a fraction, simply transpose the top number and bottom number. The reciprocal of 3/8, for example, is 8/3. (By the way, two numbers whose product is 1 are called reciprocals of each other.) You can always divide one number into another by multiplying the first number with the reciprocal of the second. Now, to solve the problem, simply follow the instructions in the "Multiplication" section above.

Modifying The Program

The numbers used in creating fractions may be increased by changing line 40. The maximum size of a number is currently 15. Be aware that larger fractions slow down the program. Take note that numbers that are too large may create answers greater than 999, which the program is not prepared to handle. You can also alter the number of problems (currently 20) by changing line 170.

See program listing on page 91.

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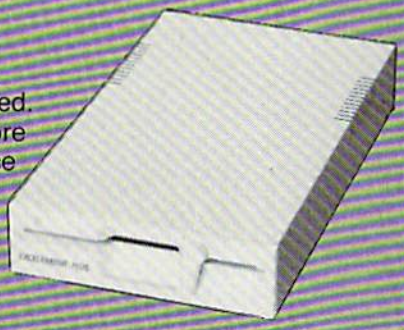

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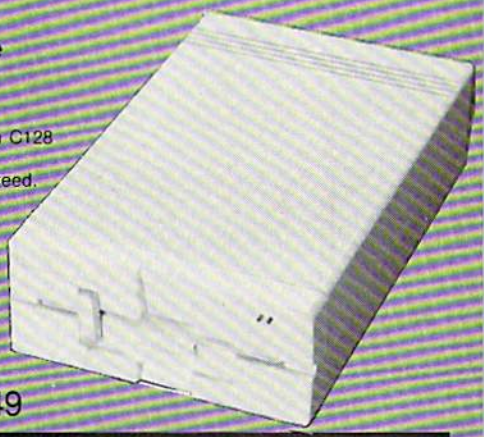

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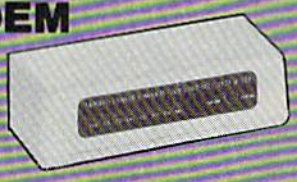

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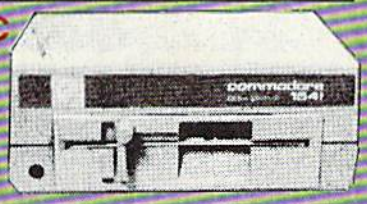

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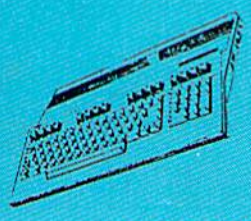

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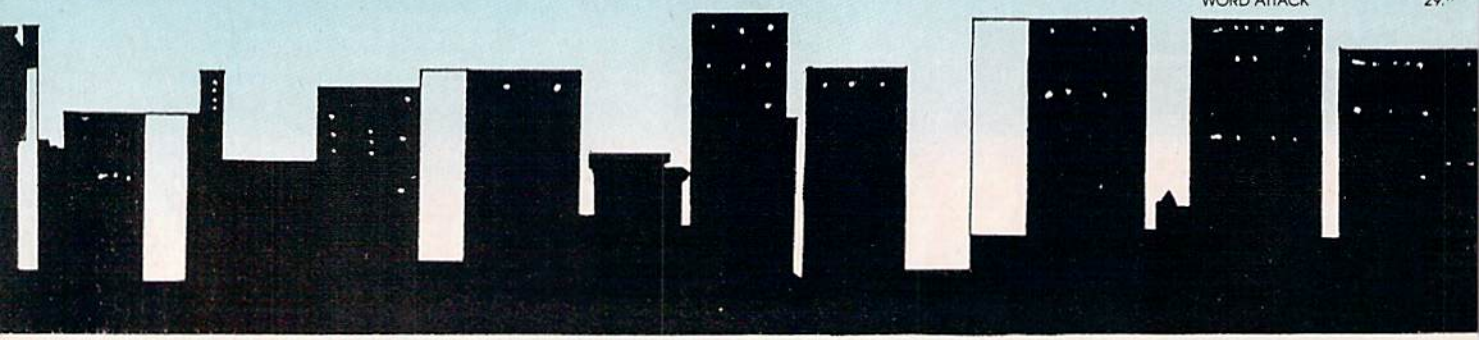

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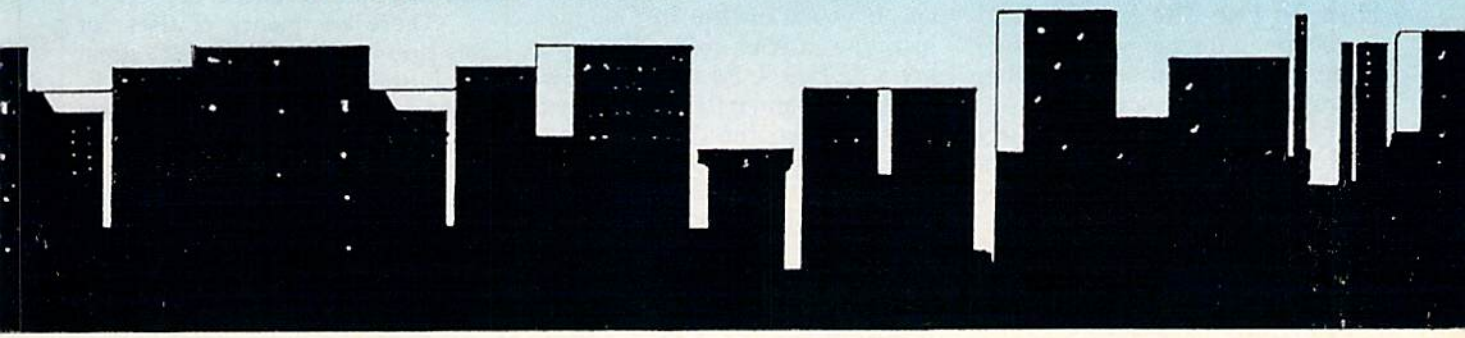


Poster Printer

John Robinson

If you need a printout with letters that can be read across the room, "Poster Printer" will do the job—and more. It prints large letters on a single page to make posters, and it prints extra large letters sideways to make banners. You can use it to print greeting cards, too. For the Commodore 64, 128, Plus/4 and 16. A printer is required.

Some printers print enlarged characters. While this works well for term-paper titles, letterheads, and so on, the letters aren't big enough to make banners, posters, and signs. For these, you need letters large enough to be seen from a distance. "Poster Printer" makes very large letters that let you make banners and signs that no one can miss. You can easily change Poster Printer to print different-sized letters, and you can use keyboard graphics characters in your posters.

There are two basic styles of posters available with this program. The banner-style poster produces the largest letters by printing them sideways down the paper. Each banner letter can be up to 80 characters high, and as wide as you choose. The other format is the single-page poster. The limits are up to five lines of text with a maximum of eight characters per line. These lines are automatically centered on the page both vertically and horizontally.

How To Use The Program

First, type in the program and save a copy. Be especially careful when typing in DATA statements. Any mistyped numbers can cause a crash. It is recommended that you load and run the "Automatic Proofreader," found elsewhere in this issue, before typing in the program.

As listed, Poster Printer runs on the Commodore 64. If you have a 128, substitute the following lines:

```
KJ 770 REM 128 CHARACTER MOVE
       {SPACE}ROUTINE
FX 780 DATA 169,208,133,252,16
       9,60,133,254,169,0
EA 790 DATA 133,251,133,253,16
       0,0,169,251,162,14
AA 800 DATA 32,116,255,145,253
       ,200,208,244,230,252
CR 810 DATA 230,254,206,38,59,
       208,235,96,4
JK 820 DATA -1
```

If you have a Plus/4 or 16, substitute these lines:

```
FQ 770 REM PLUS 4/16 CHARACTER
          MOVE ROUTINE
FX 780 DATA 169,208,133,252,16
       9,60,133,254,169,0
BS 790 DATA 133,251,133,253,16
       9,62,141,153,4,162
QQ 800 DATA 4,160,0,177,251,14
       5,253,200,208,249
HG 810 DATA 230,252,230,254,20
       2,208,242,169,63,141
PX 820 DATA 153,4,96,-1
```

To use Poster Printer, load it and type RUN. The first display presents a menu from which you can choose to print banners or posters. If you want to print banners, just type in your entry. When you press RETURN, Poster Printer will print your banner. If you choose to print a poster, you can enter up to five lines of text; but if you don't want to use all the lines, press RETURN on a blank line to finish the entry. Each line may have up to eight letters; if you wish, use any of the keyboard graphics characters. From the main menu, you can also tell your printer to form feed. This allows you to eject a page when your printout is finished.

Changing Letter Size And Spacing

For most purposes, the default character width and height are fine, but Poster Printer allows you to change letter size.

When you're printing banners, you can change the height of the letters by altering the pixel height (BH) and width (BW). For a wider character, increase BW in line 40. For a taller character, increase BH. Experiment until you get the effect you want.

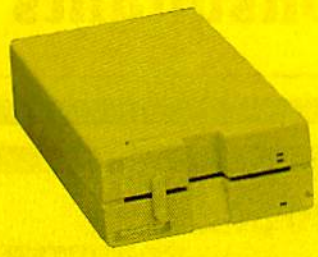
When you're printing single-page posters, you can double character width by setting PW to 2 in line 50. To change the height of the characters, change the FOR-NEXT loop in line 730. The higher the number in the loop, the taller the characters will be.

You can have white letters on a dark background by interchanging the spaces and asterisks in the lines mentioned above. You can also substitute other characters for the asterisks to achieve special effects. Try using the Commodore-key or SHIFT-key graphics characters to add that special touch.

There are plenty of uses for this simple printer utility. It's great for birthday messages and cards, and no one will miss the notes you put on the refrigerator. If you experiment with this utility, you may find that it can add a new dimension to your printing applications.

See program listing on page 103.

COMMODORE PERIPHERALS AT SPECTACULAR SAVINGS.



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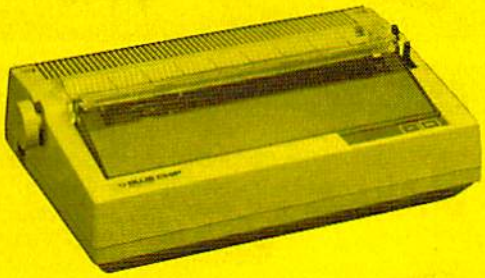

D12/10 DAISYWHEEL PRINTER.

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Manufactured to our specifications by Brother Industries, this letter-quality printer produces typed pages you'd think were produced on the most sophisticated office typewriter — on your Commodore computer. Its daisywheel typing elements are easily changed, and come in dozens of typestyles, including foreign language fonts.

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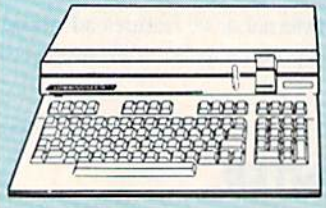

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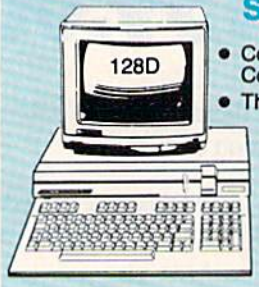
COMMODORE 128D System Special



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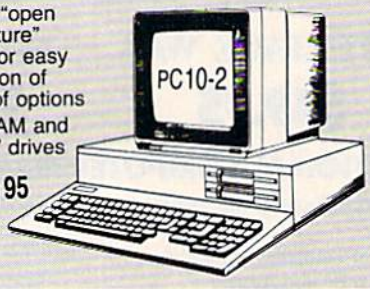

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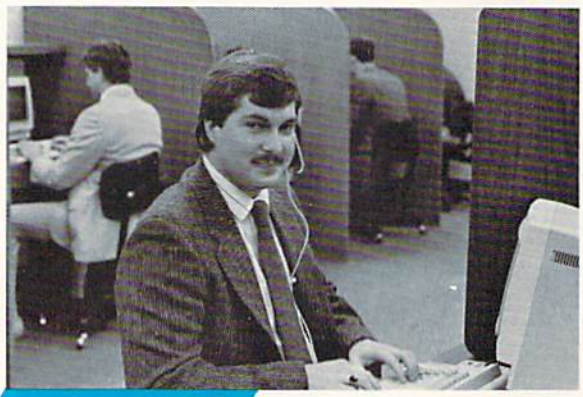

Mark "Mac" Bowser, Sales Manager

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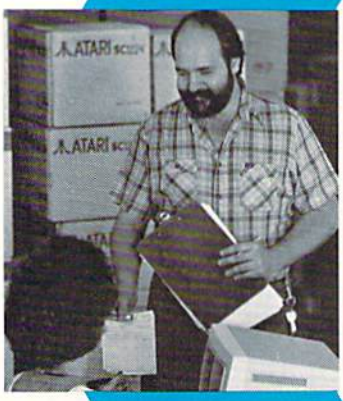

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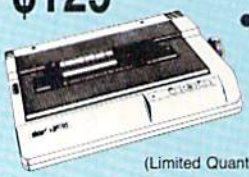

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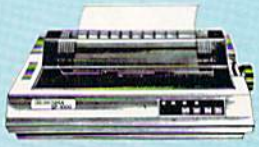

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Subprograms For The 64

James Tubbs

Here's a unique programming utility that gives you the ability to write and call subprograms in Commodore 64 BASIC. Subprograms make your BASIC programs more readable, more modular, and easier to write. A disk drive is required.

Subprograms are like subroutines, only better. Like a subroutine, a subprogram can be called from anywhere within your program, perform a specified task, and return back to the main program. What makes these subprograms better than subroutines is that they are called by name (not line number), they are stored separately on disk, and they do not disturb any of the main program's variables when executed.

The program accompanying this article—"64 Subprograms"—allows you to write a library of functions and procedures in BASIC, to save them to disk, and to call them up for later use as subprograms. With an extensive library, entire programs can be assembled from subprogram calls alone.

Getting Started

Since 64 Subprograms (Program 1) is written in machine language, it must be entered with "MLX," the machine language entry program found elsewhere in this issue.

When you run MLX, you'll be asked for a starting address and an ending address for the data you'll be entering. For Program 1, use the following values:

Starting address: 0801
Ending address: 09B8

Program 1 is only 435 bytes long, so it shouldn't take long to type in. When you have finished, save a copy of the program.

Program 2, written in BASIC, is a demo program that illustrates the use of subprograms. Programs 3 and 4 are two subprograms that are called by Program 2. Type in and save all three programs. Save Program 3 with the filename SUB1, and Program 4 with the filename SUB2. When you run Program 2, it looks for the subprograms with these names.

Writing A Subprogram

Subprograms are written like any other BASIC program. Simply type one in and save it to disk. When calling a subprogram, you refer to it by its filename, so choose your filenames carefully.

Subprograms can contain any legal BASIC command. Two BASIC commands, however, have been modified for subprogram use alone. These commands are END and LET. The END command terminates a subprogram's execution and returns control to the main program (much like the RETURN command in a subroutine). All subprograms must finish with an END.

All variables in a subprogram are local, which means that they cannot be accessed or affected by the main program. In fact, it is common for a subprogram to contain variables that are different in value, but identical in name to variables found in the main program. Because the subprogram's variables and main program's variables are separated like this, there must be some way for the two programs to pass information back and forth. This is where the new LET command comes in.

In the new LET command, periods (.) are used to flag local variables. Hence, the statement LET .A=A sets the subprogram's variable A equal to the main program's variable A. Conversely, the statement LET A=.A passes the value of the subprogram's variable A back to the main program's variable A. Both the END and LET commands behave normally when used from within the main program.

There are a few limitations that you should keep in mind when writing subprograms. First, you can pass only floating point variables through the new LET command (sorry, no strings). Numeric arrays may be passed, but only if you do not use a variable to index into the array. For example, A(2) is legal, but A(B) is not. Finally, because subprograms are loaded into mem-

ory at 49152–53247 ($C000–CFFF), your subprograms must fit within 4K of memory.

Using A Subprogram

Before you can use a subprogram, you must first load and run Program 1. Although 64 Subprograms is written in machine language, it can be loaded and run like a BASIC program. Once run, you may load, enter, and/or run your main program.

To call a subprogram, use the command: GO "*subprogram name*". It's as easy as that. Remember, the *subprogram name* is the filename of the subprogram on disk. Also, when issuing this command, the disk containing the subprogram must be in disk drive 8.

If a subprogram stops for any reason, you can return to the main program by entering END in direct mode.

A Demonstration

Program 2 demonstrates the use of subprograms. When run, Program 2 first asks you to enter a number and then calls its first subprogram. This first subprogram (listed as Program 3) takes the number entered and multiplies it by 100. After returning to the main program, you are asked to enter several more numbers. At this point the second subprogram (Program 4) is called to calculate the average of all numbers entered, including the number passed to the first subprogram. Finally, the main program prints the result and ends.

Don't be fooled by this demo's simplicity. Subprograms can perform the duties of an entire program if needed. By keeping your subprograms simple, however, your programs are easier to follow and understand.

Ideas For Use

Subprograms can be put to many uses. Do you have a program that is too large to fit in memory? Break it down into subprograms. Are your subroutines messing up your program's variables? Use subprograms instead. Having trouble loading one program from within another? Don't load the program—call it as a subprogram instead. It's easy to see that subprograms are useful and versatile aids.

See program listings on page 104.

User Group Update

Caroline D. Hanlon

This list includes updated entries to our annual "Guide to Commodore User Groups," which last appeared in the May and June 1987 issues.

When writing to a user group for information, please remember to enclose a self-addressed envelope with postage that is appropriate for the country to which you're writing.

Send typed additions, corrections, and deletions for this list to:

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User Group Notes

Basic Bits User Group has changed its address to P.O. Box 447, N. Ridgeville, OH 44039.

The **Southern Illinois Commodore User Group (SICUG)** has a new address: Rt. 1, Box 313, Goreville, IL 62939.

128 Users of Dallas/Ft. Worth has moved to 10545 Maylee Blvd., Suite B, Dallas, TX 75228.

New Listings

NEW MEXICO

64-X, 501 Camino Sin Nombre, Santa Fe, NM 87501

OHIO

Dayton Area Commodore Users Group (DACUG), 2040 Turnbull Rd., Dayton, OH 45431

OREGON

Commodore 64 Club, 3620 Grenada Way, Klamath Falls, OR 97603

PENNSYLVANIA

Commodore Users Group, Philadelphia Area Computer Society, P.O. Box 57096, Philadelphia, PA 19111-7096

WASHINGTON

University Place Commodore Home Users Group (UPCHUG), 1904 Crystal Springs Rd. W., Tacoma, WA 98466

Outside The U.S.

APO

Commodore Base User's Group (C-BUG), Attn: Computer Club Recreation Center/SSRR, RAF Chicksands, APO, NY 09193 (Near Shefford Beds., England SG17 5PZ)

CANADA

Medicine Hat Commodore Users Group, P.O. Box 764, Medicine Hat, Alberta, Canada T1A 7G7

Hamilton Commodore Users' Group, 201 Millen Rd., Stoney Creek, Ont., Canada L8E 2G6

Ultima 64 Computer Club, P.O. Box 727, Azilda, Ont., Canada P0M 1B0

C64 International Users Group, 1544 West 59th Ave., Vancouver, B.C., Canada V6P 1Z2

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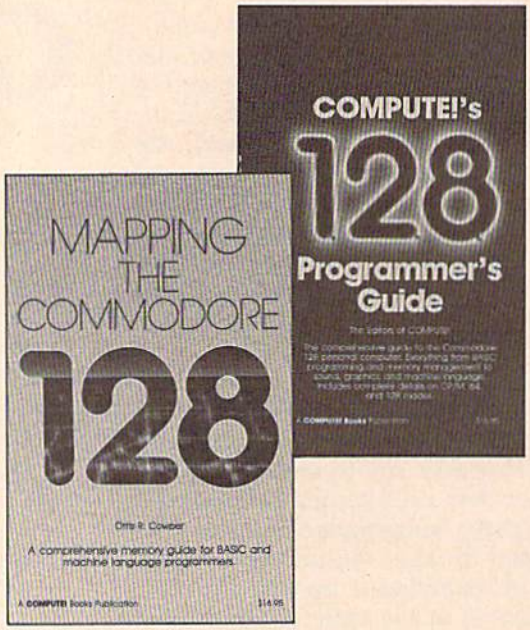

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Raeto Collin West
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SpeedScript 128 Date And Time Stamper

Robert Kodadek

Here's a utility that makes it easy to identify the date and time of any SpeedScript 128 *document.*

Imagine how valuable it would be to know the origination date of all your *SpeedScript 128* files. "*SpeedScript 128* Date and Time Stamper" adds this capability to *SpeedScript 128*. Once the program is installed, all *SpeedScript* files are automatically date- and time-stamped. A new directory routine displays all the usual information plus the date and time that each file was created. The current date and time is also displayed in full literal form—you'll see Nov 3, 1987, not 11/3/87.

Typing It In

SpeedScript 128 Date and Time Stamper consists of two programs. Be sure that you're in 128 mode when you type them in. Program 1, "*SpeedScript 128* Date and Time," is written in machine language. It must be typed in using the Commodore 128 version of the "MLX" machine language editor found elsewhere in this issue. When you run MLX, you'll be asked for the starting and ending addresses of the data you'll be entering. For *SpeedScript 128* Date and Time, respond with the following values:

Starting address: 1300
Ending address: 197F

After entering the data, save a copy of Program 1 with the filename "SS128 DATE/TIME". Program 2 expects this filename.

Program 2, "Date and Time Loader," is written in BASIC. After typing it in, be sure to save a copy onto the same disk on which you saved Program 1.

To use *SpeedScript 128* Date and Time Stamper, load and run the BASIC loader (Program 2). It will automatically load Program 1. You'll then be prompted for the current date and time. The program screens out incorrect data and proceeds to the next prompt only after you've supplied the information in the required format. At this point you'll be asked to insert a disk containing a copy of the *SpeedScript 128* word processor. This file must be named SPEEDSCRIPT 128. After you've pressed RETURN, *SpeedScript 128* is loaded. From now on, the date and time are stamped onto every file you save from within *SpeedScript 128*. To see the information, press CTRL-4 for the modified directory. If you plan to regularly use this utility, include these programs on the same disk with *SpeedScript 128* (with the filename SPEEDSCRIPT 128). This will simplify the loading procedure.

Behind The Stamp

The actual stamping occurs in an unused area in the directory sector of the file and is accomplished by a machine language routine which is sent into the disk drive itself. The stamping operation is immediate, and the entire disk is still available for storage. A stamped disk may still be used normally, since the date and time stamp is transparent to the standard DOS routines.

The new directory is accessed in the normal fashion—by pressing the CTRL-4 key combination. This routine prints the current date and time at the top of the screen followed by the directory information. All of the usual information is displayed in the typical Commodore layout. However, the file type had to be abbreviated in order to accommodate the date and time stamp information. The file types are displayed as PG, SQ, UR, and RL, and are self-explanatory. So-called *poison* (or *splat*) and *locked* files are indicated as usual. Also notice that filenames are no longer in quotes. The listing can be paused by pressing the NO SCROLL key and stopped by pressing RUN/STOP.

The program doesn't alter *SpeedScript 128*'s other functions in any way. You'll notice after saving a document that the drive light will come back on momentarily. This is the date and time stamp being applied to the directory sector of the file. The utility is disabled when you exit *SpeedScript 128*. To restart, type SYS 4908.

See program listings on page 99.

Renumber 64

Hubert Cross

Every programmer needs a renumbering utility. Here's one that's efficient, fast (operating at machine language speed), and easy to use. It renumbers your program at the press of a function key—you choose the starting line number and the increment between the lines.

In general, BASIC programs pass control from one line to the next sequentially—line 10 before line 20, line 20 before line 30, and so on. Exceptions occur when control statements like FOR-NEXT and GOTO are encountered.

Programmers, however, don't always write programs in the order that they run. Often you may find that you need to insert a new line where there's no room for one, say, between lines 345 and 346. "Renumber 64" takes care of just that kind of situation.

At first thought, renumbering a program may seem trivial—after all, only the line numbers are changing, right? Wrong. The destinations of GOTOs, GOSUBs, ON-GOTOs, and ON-GOSUBs will probably change, too. Let's take a look at a small section of code which must be renumbered.

```
1 INPUT A
2 ON A GOTO 20,30,40
3 PRINT "BAD INPUT":GOTO 1
20 PRINT "ONE":GOTO 1
30 PRINT "TWO":GOTO 1
40 PRINT "THREE":GOTO 1
```

Carefully compare this to the renumbered version.

```
100 INPUT A
110 ON A GOTO 130,140,150
120 PRINT "BAD INPUT":GOTO 100
130 PRINT "ONE":GOTO 100
140 PRINT "TWO":GOTO 100
150 PRINT "THREE":GOTO 100
```

As you can see, renumbering requires some work.

With Renumber 64 installed, you can renumber your BASIC programs at machine language speed by pressing f1.

Getting Started

Renumber 64 is written entirely in machine language, so you'll have to enter it using the "MLX" machine language entry program found elsewhere in this issue. After you run MLX, you'll be prompted to enter the starting and ending addresses for the data. Enter these addresses:

```
Starting address:  C000
Ending address:    C4D7
```

Once you have typed in the data for Renumber 64, save a copy to disk or tape before leaving MLX. When you're ready to use the program, type LOAD "*filename*",8,1 (for disk) or LOAD "*filename*",1,1 (for tape), where *filename* is the name you used when you saved the program. Type NEW to clear out the BASIC pointers and to prevent an OUT OF MEMORY error.

Now type SYS 49155—you'll see the message RENUMBER ENABLED. From this point on, you need only to press the f1 key to renumber the BASIC program in memory.

By default, Renumber 64 uses an initial line number of 100 and increments the line numbers by 10's. If you want a different initial line number or increment, type SYS 49152,*initial*,*increment*. For example, use SYS 49152,1000,1 to start the program with line 1000 and increment the line number by 1 for each following line. Note that executing the SYS to change the initial line number or the increment will automatically renumber your program.

If your program references any line numbers that do not exist, the references will be changed to 63999. Always remember to check your program for this value after renumbering.

Since the renumbering program is located in memory addresses 49152–50391, be sure that your BASIC program does not POKE into this area.

For short programs, renumbering is almost instantaneous. Longer programs can take up to a minute to renumber. That's a small price to pay for a more organized program.

See program listing on page 101.

Sprite Monitor

Harry Werner

Here's a unique utility that allows you to search through memory for sprites and then capture them. For the 64. A disk drive is recommended.

"Sprite Monitor" is a handy tool that lets you view memory as hi-res or multicolor sprites. By loading your favorite graphics programs and then executing Sprite Monitor, you can snoop through memory in search of those once-mysterious sprite definitions. If you find any sprites that you want to capture, Sprite Monitor will save them to disk for later use or modification in your own programs.

Besides being useful on this level, Sprite Monitor provides insight into how various programs make use of sprite graphics.

Typing It In

Sprite Monitor is written entirely in machine language for maximum speed and minimum size. We have included two versions of Sprite Monitor—one resides at location 20480 ($5000), the other at 49152 ($C000). Type them in with the "MLX" machine language entry program found elsewhere in this issue. When MLX prompts you for the starting and ending addresses of the data, respond with the following values:

Program 1:
Starting address: 5000
Ending address: 535F

Program 2:
Starting address: C000
Ending address: C35F

When you've finished typing in all the data, be sure to save a copy to tape or disk before leaving MLX.

Using Sprite Monitor

First, run a program that uses sprites. [Ed. *"Litterbug," a game found elsewhere in this issue, is a good example of such a program.*] Exit the program (you may have to press RUN/STOP–RESTORE). Next, load Sprite Monitor with the statement:

LOAD *"filename"*,8,1 (tape users substitute ,1,1)

Replace *filename* with the name you used to save the machine language file. If you load Program 1, type SYS 20480 to activate Sprite Monitor. If you use Program 2, type SYS 49152. Both versions behave exactly the same, so you can choose the one that is less likely to disturb the other programs in memory.

Now, you can search through memory for sprites. The memory address that you are currently viewing is displayed in hexadecimal at the top of the screen. Eight sprites are displayed on the screen at a time. Each sprite reflects 64 bytes of memory. So, with eight sprites, you are viewing 512 bytes of memory (8 × 64 = 512). The upper left sprite is defined by the first 64 bytes of memory, while the lower right sprite is defined by the last 64 bytes.

Every function in this program is accessed through a single keypress. The following is a list of these keypresses and their definitions:

+ Sets monitor to move forward through memory.

− Sets monitor to move backward through memory.

F Fast scan. Moves quickly through memory in the direction specified by the + and − keys.

SPACE Slow scan. Moves slowly through memory in the direction specified by the + and − keys.

***** Expands or contracts sprite's vertical and horizontal size.

M Toggles multicolor mode.

0–7 Changes color of sprites. Pressing the 0 key changes the color of the first sprite while 7 changes the color of the last sprite.

C Changes screen's background color.

B Changes screen's border color.

S Saves sprite definitions to disk. You have four options when you press this key: You may save the First sprite (F), the Top four sprites (T), or All sprites (A); or you may Exit the save option (E).

Before saving sprites to disk, you are prompted for a filename. You may also abort the save option by pressing Return without entering a filename. Sprites that are saved to disk are saved as machine language files. These files can be loaded using the following syntax:

LOAD *"filename"*,8,1

The sprites will be loaded into memory at the same location from which they were saved.

If you search through memory and can't find the sprites, try using the other version of Sprite Monitor—it's possible that Sprite Monitor itself may have overwritten the sprites when it was loaded.

See program listings on page 98.

Barricade Buster

Accessing The 128's 80-Column Screen

Robert Bixby

Here's a very short routine that goes a long way in power: It allows easy, full access to the 128's 80-column video memory. Versions for 128 mode and 64 mode are included, as is a demo program.

One of the most attractive features of the Commodore 128 is its 80-column screen. Yet accessing the 80-column screen can be very frustrating for BASIC programmers. You can't PEEK or POKE its screen memory, attribute memory, or any other of the 16,384 locations found in the 16K of dedicated video memory.

"Barricade Buster" solves this problem with a very short (78 byte) machine language routine. This routine gives you the ability to read and write to the 80-column screen, simply and easily. There is even a version for accessing the 80-column screen from 64 mode. To show what can be accomplished with direct screen access, a sample game, "Pizza Raid," is included.

Typing It In

There are three programs which accompany this article: Program 1, the 128 version of Barricade Buster; Program 2, the 64 version; and Program 3, the sample game, Pizza Raid. Use the "128 MLX" machine language entry program found elsewhere in this issue to enter these programs. When you run MLX, answer the prompts as follows for each program:

Program 1
Starting address: 1300
Ending address: 134F

Program 2
Starting address: 0334
Ending address: 0383

Program 3
Starting address: 1300
Ending address: 16D7

If you are interested in running only the Pizza Raid game, just type in Program 3. Note that to run any of these programs, you must have a monitor capable of displaying the 128's 80-column screen.

An Example With Extra Cheese

Before using Barricade Buster, you may want to run Program 3—Pizza Raid—to get an idea of the advantages of directly accessing the 128's video memory. The main advantage presented in Pizza Raid is speed. By reading and writing to the 80-column screen, updating the program's character graphics is made quicker and easier.

To run Pizza Raid, you must be in 128 mode with the 80-column screen selected as the active display. If you are using tape, load the program using a ,1,1 extension. Disk users should BLOAD the program. After loading, type SYS 4942 to run the game.

In Pizza Raid, you are transporting a cargo of pizzas to the fourth gas planet of Betelgeuse where a serious cheese famine threatens to destroy the population. Half way to your destination, your vessel is disabled by a voracious space weevil. Not interested in you, the space weevil attacks your cargo. In defense, you have two force fields to protect either the top and bottom or the left and right sides of your cargo. Pressing the cursor-down key protects the top and bottom, while the cursor-right key protects the left and right sides of your cargo. When the weevil has succeeded in eating all but 128 pizza wedges, the game is over. The longer you can prevent this from happening, the higher your score will be. The top of the screen displays your score and the number of pizza wedges left in inventory. To play again, press RETURN.

Using Barricade Buster

First, load the appropriate version of Barricade Buster: Program 1 for 128 mode and Program 2 for 64 mode. Because these programs are written in machine language, you must LOAD them using a ,1 extension.

There are five memory locations to remember when using Barricade Buster in either 128 or 64 mode:

Memory locations		Function
128 mode	64 mode	
4864	820	Byte to PEEK or POKE
4865	821	Low byte of video memory
4866	822	High byte of video memory
4867	823	SYS for PEEK routine
4870	826	SYS for POKE routine

Let's try a sample program. If you are using the 128 version, enter the following line:

```
10 BA=4864
```

If you are using the 64 version, enter this line:

```
10 BA=820
```

Now, type in the following BASIC program lines:

```
20 POKE BA,1:REM SCREEN CODE FOR 'A'
30 POKE BA+1,232:POKE BA+2,3:REM SCREEN ADDRESS 1000 IN LOW-BYTE/HIGH-BYTE
40 SYS BA+6:REM POKE 80-COLUMN SCREEN
50 POKE BA+1,232:POKE BA+2,3:REM SCREEN ADDRESS 1000 IN LOW-BYTE/HIGH-BYTE
60 SYS BA+3:REM PEEK 80-COLUMN SCREEN
70 PRINT PEEK(BA):REM PRINT VALUE RETURNED
```

Run the program with the 80-column screen active. (When running this demo in 64 mode, you must first boot your computer in 80-column 128 mode and then execute a **GO 64**. To test if the demo is working, switch your monitor to the 80-column screen, then back to 40 columns to see what you are typing.) When you run the demo, you'll see the letter *A* (which has a screen code of 1) appear in the center of the 80-column screen. To verify that the value was successfully stored in screen memory, line 60 PEEKs the 80-column screen and line 70 prints the result.

Remember that the address of the first location on the 80-column screen is 0. The last location is 2047, but the last *visible* location is 1999. The entire 16K of video memory area is divided up as follows:

0000-2047/$0000-$07FF	Screen memory
2048-4095/$0800-$0FFF	Attribute memory
4096-8191/$1000-$1FFF	Unused
8192-16383/$2000-$3FFF	Character definitions

Attribute Memory

Color memory on the 80-column screen is called *attribute memory*—it has a much more complex interaction with the character screen than color memory has in 40-column mode. You may POKE attribute memory with values that will reverse, flash, underline, and determine the case (upper or lower) of characters.

The first four bits of a byte in attribute memory—bits 0 through 3—specify the color (0–15) of a character. If the fourth bit is set (equal to 1), the letter will flash. The fifth bit determines whether the character will be underlined or not. If the sixth bit is set, the character will be displayed in reverse video. The seventh bit determines whether the character is upper- or lowercase. If this last bit is set—giving the attribute byte a value greater than 127—the letter is displayed in lowercase.

Use In 64 Mode

Barricade Buster offers some unique possibilities in 64 mode. If the 80-column screen isn't needed, Barricade Buster gives 64 mode an extra 16K of RAM. Although you can't use this 16K for extending the BASIC workspace, you can use it for storing data. You can store a pair of high-resolution screens here, or use it for a ramdisk. A 64 program that uses this extra memory, however, will run only on a 128 in 64 mode.

See program listings on page 100.

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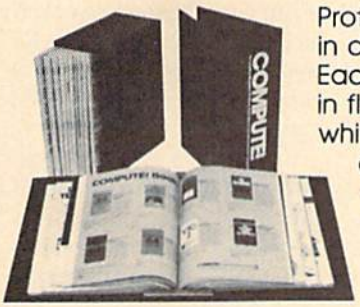

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Top Secret

Gilles Breton

Do you have a special programming technique you don't want to share just yet? Or do you need to keep your DATA statements under wraps? Protect your BASIC programs from prying eyes with this clever utility. Top Secret works on the Commodore 64, +4, and 16.

If you have a program you wish to protect, you'll appreciate "Top Secret," a programming utility that lets you scramble any BASIC program.

Why would you want to protect programs? Here's a scenario that might apply to you. You have a whole disk full of programs that you've written or collected. You'd like to share *some* of these programs with *some* people. Using Top Secret, you protect each one, giving each a unique password. Now, you can lend out the whole disk, giving each friend only the appropriate passwords.

Top Secret works by combining the characters in your program with the characters in your password. It's important to remember the password that you use to scramble a program—without it, the program is useless. The safest strategy is to keep at least one copy of the program in unprotected form on a disk or tape in a secure place.

Typing It In

Top Secret is a machine language program in the form of a BASIC loader. Since it must be typed accurately, be sure to use "The Automatic Proofreader," found elsewhere in this issue, when you enter the program. After you've finished typing the program, be sure to save a copy before running it—the program performs a NEW when it's run.

To use Top Secret, load and run the program. Top Secret POKEs a machine language routine into memory and then moves the bottom of BASIC up to protect it. Top Secret also prompts you with the address that you need to activate it. Next, load the BASIC program that you wish to protect and enter the SYS address to call Top Secret. The program asks for a password. Type in an alphabetic password (using no numbers or special characters) of no more than 69 characters. Then select *C* to encode the file. Save the scrambled program.

When your friend wants to decode the program, have him or her follow these instructions. Load and run Top Secret. Load the scrambled program, type SYS 2049, and enter the password. Press *D* to decode the program. The program is restored to its original form and is ready to run. All that is needed is this point is to type RUN.

Technical Notes

The technique used by Top Secret is almost impossible to break. It combines the first character of the password with the first character of the BASIC program, the second character with the second character, and so on. When the end of the password is reached, the process begins again with the first letter of the password. Be sure to choose a password that will not be guessed—for example, don't choose something obvious, like your name. If you keep a written record of your passwords, be sure to keep it in a safe place.

Top Secret locates the machine language portion of itself at the start of BASIC memory and then raises the pointer for the start of BASIC. Therefore, this utility will not work on machine language programs that load like BASIC programs. Also, if your program is very large, you may run out of room when you have Top Secret installed. (Your program would have to be *very* large for this to happen.)

See program listing on page 102.

The Beast With Two Brains

Todd Heimarck
Assistant Editor

Most computers have just one microprocessor, just one brain. The Commodore 128 is unusual because it has two brains: an 8502, which is responsible for both 64 mode and 128 mode, and a Z80, which handles CP/M mode.

To use CP/M, you need a 128, at least one disk drive, a TV or monitor, and the CP/M disk that came with the computer. Turn on your drive, insert the disk, and turn on your computer (from 128 mode, you can also type BOOT).

The 1571 drive is better suited to CP/M work than the 1541 because it's faster and can read disks created on Kaypro, Osborne, and Epson CP/M computers. An 80-column screen is preferable because in 40-columns you have to scroll back and forth to see the whole display area. If you own a modem, you're in luck—there are still lots of CP/M bulletin boards from which you can download programs. A RAM expander is an excellent accessory because CP/M is disk-intensive and it uses the extra memory as a ramdisk.

Where Are The Programs?

The CP/M disk is a flippy, which means you can flip it over to use the programs on side two. You get the operating system and a bunch of utilities for doing things like formatting disks and copying files. But there's no programming language, not even BASIC, so you can't write your own programs. You won't find any applications or games either, so you can't run any programs (except to do things like formatting disks and copying files).

If you can't write programs and you can't run programs, what good is CP/M?

Fortunately, you can find many languages, applications, and games, both commercially and in the public domain, for CP/M. Commercial languages include *Microsoft BASIC* and *Turbo Pascal*. In the public domain are versions of Lisp, Forth, C, Fortran, Pascal, Modula-2, and other languages. Popular applications include *WordStar* and *dBase II*. Public domain games are also available, including chess, backgammon, the original *Adventure*, and others.

Assuming that you have a modem, you can download quite a number of programs. First, you need a terminal program that works in CP/M mode. I use one called *Modem Executive* or MEX.COM, for short. (Executable programs end with the .COM extension.) CP/M programs available for downloading are often compressed. This process reduces the file size, which means you spend less time online and pay less in connect charges—on a commercial service—or you pay less in long-distance bills on a bulletin board. The utility that unsqueezes files is called USQ.COM. Another useful utility is NULU.COM, the "new library" utility, which combines several files into one library and dissolves them, too. VDE.COM and VDO.COM are two versions of a good public domain text editor.

It's possible to use a terminal program in 64 or 128 mode to download CP/M programs to a Commodore-format disk, but you need a separate program that will read a Commodore disk and copy the program to a CP/M disk.

Paradoxically, the public domain programs are free and you can give copies to friends, but to download the programs, you generally have to go to a telecommunications service like CompuServe, where you pay for connect time, or call a bulletin board, which is often a long-distance call. It's easy to drop a couple hundred dollars on a few dozen free programs.

Money Saver

Innovative Computer Accessories (INCA) sells a package called CP/M KIT, which contains a 39-page booklet and two disks. One of the disks is a flippy. The 40 files on the three disks are split between programs you can run and documentation files. The programs are all public domain, so you can make copies and give them away without breaking the law. INCA claims a copyright only on the booklet.

INCA also sells an 80-column cable which will give you 80 columns (but no color) on a composite monitor such as the 1701 or 1702 in both CP/M mode and 128 mode.

The programs on the INCA disks include C1571 (speeds up disk writes); CONF (configures system variables); DD, SD (disk directory); DE-LBR, LDIR, LRUN, LTYPE, NULU (library utilities); MCAT (a useful disk cataloguing program); MEX128 (terminal program); NEWSWEEP (a versatile utility with several functions); SCAN (reads and displays squeezed and normal files); SQ, USQ (squeeze and unsqueeze); VDE (text editor); XCAT (cross-reference and alphabetizing utility for MCAT); and ZCHESS (a *Sargon*-like chess program). If you were to download all the files and their documentation at 300 baud, it would take roughly four to five hours. The INCA package is reasonably priced, especially when you consider that the programs are public domain and may be freely distributed.

Innovative Computer Accessories
1249 Downing St.
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BASIC for beginners

The MID$ Function

Larry Cotton

Over the last couple of months, we've extracted the left and right ends of strings with LEFT$ and RIGHT$. This month we'll investigate the MID$ function, which extracts characters from *anywhere* within a string.

The syntax for MID$ is slightly more complex than for LEFT$ and RIGHT$. Enter the program below and run it to see how all three work:

```
HG 10 N$="FRANK LLOYD WRIGHT"
FX 20 PRINT "{CLR}"
SR 30 F$=LEFT$(N$,5)
FB 40 M$=MID$(N$,7,5)
HE 50 L$=RIGHT$(N$,6)
SP 60 PRINT "HIS FIRST NAME IS
      "F$"."
KR 70 PRINT "HIS MIDDLE NAME I
      S "M$"."
FH 80 PRINT:INPUT "WHAT'S HIS
      {SPACE}LAST NAME";LN$
RX 90 IF L$<>LN$ THEN PRINT:PR
      INT "THAT'S NOT WRIGHT!"
      :GOTO 80
SE 100 PRINT:PRINT "THAT'S RIG
       HT! IT'S "L$"!"
```

Notice that MID$ (line 40) requires an extra number that LEFT$ and RIGHT$ don't. This number specifies *where* in the string to begin reading characters. LEFT$ and RIGHT$ don't need this number because they automatically begin their search from the left or right end of a string. Incidentally, the name FRANK LLOYD WRIGHT in line 10 doesn't really need any spaces (more on this later).

In line 40, the 7 in the parentheses means to start looking seven positions from the left end of the string—at the L in LLOYD. Be sure to count the space and the first character. The 5 is the number of characters, or in this case, the length of the name to be extracted.

The way to remember which number does what is to think "the first number is the first position" for the extracted string.

More Word Extraction

The information inside the parentheses in a MID$ statement—representing the original string, the starting position, and the length of the extracted string—is called an *argument*. As in LEFT$ and RIGHT$, MID$'s arguments can be represented by constants or variables. Now type in these lines:

```
JD 10 F$="BROWNCOLUMBIACORNELL
      DARTMOUTHHARVARD"
BC 20 S$="PRINCETONUNIVERSITY
      {SPACE}OF PENNSYLVANIAYA
      LE"
PD 30 IL$=F$+S$
```

Line 30 assembles one long string from the two shorter strings defined in lines 10 and 20. This technique is necessary because the combined string will not fit on one program line in all versions of Commodore BASIC. (In the Commodore 64, a BASIC program line is limited to 80 characters. The version of BASIC for the Plus/4 and 16 allows 88-character lines, while the Commodore 128 allows 160.)

As mentioned above, spaces aren't really necessary when storing several names within one string. Except where an extracted string consists of several words, such as University of Pennsylvania, spaces just waste memory. BASIC doesn't allow stings longer than 255 characters, so be sure the length of a string doesn't exceed 255. Now, let's see what we can do with this super-long string.

We can start by printing one of these Ivy League school names—say, Cornell. Counting from the left, we see that the first letter of Cornell is in the fourteenth position, and the name is seven characters long. With this information, add these lines:

```
FA 40 PO=14:LE=7:GOSUB 100:PRI
      NT "{CLR}":PRINT:PRINT:P
      RINT COLLEGE$:END
SK 100 COLLEGE$=MID$(IL$,PO,LE
       ):RETURN
```

Try to make a habit of using variable names with some significance, such as IL$ for Ivy League, PO for position number and LE for length. Another reminder: Only the first two letters of a variable's name are used by BASIC. For example, to BASIC, the variable CO$ is the same variable as COLLEGE$.

When you want to print another college from the list, simply change the beginning character position (variable PO) and string length (variable LE). To print Princeton, for example, change line 40 to read like this:

```
XQ 40 PO=37:LE=9:GOSUB 100:PRI
      NT "{CLR}":PRINT:PRINT:P
      RINT COLLEGE$:END
```

Extracting Single Characters

The MID$ function is used often for extracting single characters from a string:

```
HC 10 A$="ABCDEFGHIJKLMNOPQRST
      UVWXYZ"
XF 20 PRINT "{CLR}":PRINT:PRIN
      T
PE 30 PRINT "THIS PROGRAM PRIN
      TS OUT A LETTER"
PR 40 PRINT "OF THE ALPHABET T
      HAT'S IN THE"
SB 50 PRINT "POSITION YOU TYPE
      ."
JA 60 N=0:PRINT:INPUT "WHAT'S
      {SPACE}A NUMBER FROM 1 T
      O 26";N
XC 70 IF N=0 THEN END
PF 80 IF N<1 THEN 60
FP 90 IF N>26 THEN 60
JF 100 L$=MID$(A$,N,1)
XR 110 PRINT:PRINT "THE LETTER
       IN POSITION"N"IS "L$".
       "
```

Lines 30–50 print a message on the screen. Line 60 then prints a blank line and asks the user for a number from 1 to 26. Lines 80 and 90 utilize IF-THEN to check that the entered number is in the range 1 to 26, inclusively. Line 100 uses MID$ to find one letter in the Nth position in A$.

Other Uses For MID$

It's interesting (and fun) to use FOR-NEXT in conjunction with the MID$ function to print words or names on the screen one character at a time. For example, type NEW and enter this short program:

```
CE 10 PRINT "{CLR}":PRINT:PRIN
      T
DG 20 PRINT "WHAT'S YOUR NAME
      {SPACE}(FIRST & LAST)"
SF 30 INPUT N$
DH 40 PRINT:PRINT "NOW COUNT T
      HE LETTERS IN YOUR NAME.
      "
HM 50 PRINT "BE SURE TO COUNT
      {SPACE}THE SPACES"
EF 60 PRINT "BETWEEN THE FIRST
       AND LAST NAMES."
CR 70 PRINT:INPUT "HOW MANY";N
      L
BA 80 PRINT:FOR J=1 TO NL
CQ 90 PRINT MID$(N$,J,1);
KA 100 FOR D=1 TO 100:NEXT D
EQ 110 NEXT J
```

Be sure to type a semicolon at the end of line 90 to insure that your name is printed all on one line.

Let's see how this works: Your name and its length are assigned to the variables N$ and NL in lines 30 and 70, respectively. (Next month we'll see how to automate part of this process using the BASIC function LEN.) Nested FOR-NEXT loops are used in lines 80–110 to print your name one letter at a time. The outer loop does the printing while the inner loop creates a short time delay. The variable J is used as the character position pointer in the MID$ statement. In line 80, J is incremented from 1 to NL—the length of the name.

As J increments, line 90 prints the letters in your name, slowly, one after the other. Before the NEXT J is encountered in line 110, an inner loop adds a short delay after each character is printed. The printing speed can be varied by changing the delay loop in line 100.

Scanning

Another use for MID$ is to scan a long string for a particular character. This can be done by using a combination of FOR-NEXT and IF-THEN statements. The following program searches a string of jumbled letters for a letter entered by the user:

```
AS 10 PRINT "{CLR}"
FS 20 R$="ABIWOEJYTRMVPYIU"
KK 30 PRINT R$:PRINT
CR 40 INPUT "WHICH SINGLE LETT
      ER TO SEARCH FOR";L$
JK 45 PRINT
HD 50 FOR N=1 TO 16
SG 60 M$=MID$(R$,N,1)
DQ 70 IF M$=L$ THEN PRINT L$"
      {SPACE}IS IN POSITION NO
        "N:C=C+1
AK 80 NEXT
SC 90 IF C=0 THEN PRINT:PRINT
      {SPACE}L$" NOT FOUND.":G
      OTO 40
CP 100 END
```

Lines 10–30 clear the screen and print the random letters. Line 40 gets the user's input in L$. Lines 50–70 form a FOR-NEXT loop which scans R$ one character at a time. In line 60, the MID$ function makes M$ equal to the Nth character in R$. Line 70 checks for a match between M$ and L$ with an IF-THEN statement. If there's no match, control immediately moves on to the NEXT in line 80 which, in turn, sends control back to line 50 to increment N.

Each time a match is found for L$, line 70 prints a message and C is incremented by 1. The variable C keeps track of the number of matches.

After the loop has incremented 16 times and each match (if there were any) has been printed out, line 90 checks to see what the value is for C. If it's zero, no matches were found, and an appropriate message is printed.

There are several other tricks you can do with strings; we'll discuss them next month.

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bug-swatter

• "Bounty Hunter" (August) uses PRINT statements with lots of cursor control characters to build the maps. From the point of view of a programmer, this method is the easiest way to build the maps; from the point of view of someone typing it in, this method is a nightmare. Several readers have been unable to get the checksums correct in lines 720, 730, 740, and 930. The difficulty with line 720 is caused by a missing question mark after MOVE. The problems with lines 730, 740, and 930 all stem from spaces at the end of those lines of text. The following listing should clear up any questions.

```
GS 720 PRINT"{RVS}{6 SPACES}N
       {SPACE}M{P}{3 SPACES}
       {*}{OFF}{WHT}MOVE?{CYN}
       {16 SPACES}{RVS}£
       {2 SPACES}{OFF}
EH 730 PRINT"{RVS}{6 SPACES}
       {H}{3 SPACES}MN{OFF}
       {SPACE}{RVS}£
       {2 SPACES}{*}{OFF}
       {11 SPACES}{RVS}{H}
       {2 SPACES}{H}{SPACE}
       {H}{N}{3 SPACES}{*}
DM 740 PRINT"{RVS}{6 SPACES}M
       {5 SPACES}{OFF}{SPACE}
       {RVS}{3 SPACES}{OFF}£
       {11 SPACES}{RVS}{H}
       {2 SPACES}{H}{SPACE}{H}
       {N}{SPACE}{OFF}£
HK 930 PRINT"{2 SPACES}{RVS}
       {7 SPACES}{*}{OFF}
       {8 SPACES}{*}{RVS}
       {4 SPACES}{OFF}{SPACE}
       {*}{RVS}{2 SPACES}
       {OFF}{SPACE}{3}L{10 P}
       @{CYN}";
```

• Bounty Hunter isn't the only program from the August issue that is difficult to type in. Many readers have had problems typing the complicated PRINT statements from "Give 'N' Take." The lines giving the most trouble are listed below. Spaces seem to be causing most of the trouble, so single spaces are shown using the same notation normally used for multiple spaces.

```
HH 1310 PRINT"{CYN}{OFF}#{8}
        {RVS}{30 SPACES}{7}
        {OFF}#{CYN}){*{8}{RVS}
        {SPACE}{CYN}{OFF}#{8}
        {RVS}{SPACE}{CYN}{OFF}
        #{8}{RVS}{SPACE}{CYN}
        {OFF}'{8}{RVS}{SPACE}
        {PUR}{2 SPACES}";
EB 1320 PRINT"{18 SPACES}{8}
        {SPACE}{7}{OFF}){*{8}
        {RVS}{SPACE}{7}{OFF}#
        {8}{RVS}{SPACE}{7}
        {OFF}#{8}{RVS}{SPACE}
        {7}{OFF}'{CYN}${8}
        {RVS}{SPACE}{CYN}{OFF}
        ${8}{RVS}{SPACE}{CYN}
        {OFF},(+{8}{RVS}
        {SPACE}{CYN}{OFF}${8}"
        ;
MM 1400 PRINT"$)%${PUR}{RVS}
        {SPACE}{8}{17 SPACES}
        {CYN}{OFF}#{8}{RVS}
        {2 SPACES}{PUR}{SPACE}
        {5}{OFF}#,+&*',{RVS}
        {@}{OFF}%#$#$)*'&*
        {PUR}{RVS}{SPACE}{8}
        {5 SPACES}";
BQ 1410 PRINT"{3 SPACES}{7}
        {OFF}#{8}{RVS}{SPACE}
        {CYN}{OFF})%{8}{RVS}
        {SPACE}{CYN}{OFF}&*{8}
        {RVS}{SPACE}{CYN}{OFF}
        &{RVS}{@}{OFF}%{8}
        {RVS}{SPACE}{PUR}
        {SPACE}{5}{OFF}')%#$$&
        {RVS}{SPACE}{OFF}%";
MK 1470 PRINT"{7}{OFF}#{8}
        {RVS}{SPACE}{7}{OFF}-+
        {8}{RVS}{SPACE}{CYN}
        {OFF},%{8}{RVS}{SPACE}
        {CYN}{OFF}&+{8}{RVS}
        {SPACE}{CYN}{OFF}${8}
        {RVS}{3 SPACES}{PUR}
        {SPACE}{5}{OFF}&(%$,%,
        (+";
EG 1480 PRINT",%$&{RVS}{@}
        {OFF}%$&+{PUR}{RVS}
        {SPACE}{8}{SPACE}{7}
        {OFF},%{8}{RVS}{SPACE}
        {7}{OFF}&+{8}{RVS}
        {SPACE}{7}{OFF}${8}
        {RVS}{7 SPACES}";
```

• "Screen Maker" (September) contains a superfluous question mark in line C790 which makes it impossible to read the first data value in that line. That line is relisted below.

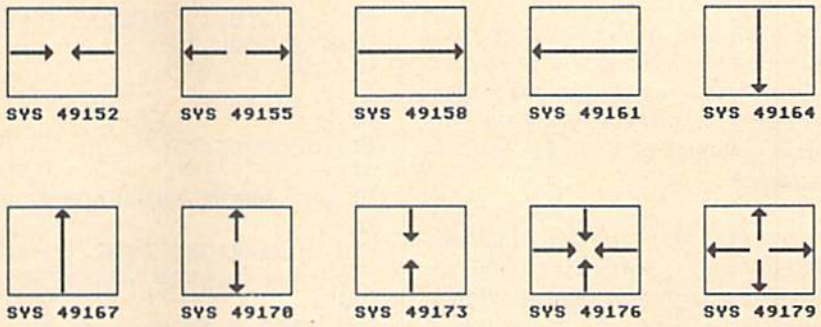
```
C790:85 FD C6 FE A0 02 8A 91 DE
```

Rhett Anderson and David Hensley, Jr.

Here's a high-speed, versatile clear-screen routine that will add spice to your BASIC or machine language programs. A demo program is included. For the Commodore 64.

Almost all programs need to clear the screen at one point or another. Printing a clear-screen character, CHR$(147), is the quickest, most efficient, and most common technique for clearing the screen. It's also probably the most boring.

"Crystal Clear" replaces the normal clear-screen command and lets you clear the screen with any one or any combination of ten patterns (see the accompanying figure). You can control the speed at which the screen clears, and you also can specify any character and color you want to clear it with.



"Crystal Clear" offers ten unique patterns for gracefully clearing the screen. Each pattern can be used with the color or graphics character of your choice.

Typing It In

Although it is written in machine language (ML), Crystal Clear (Program 1) is stored in the DATA statements of a BASIC program. A demo program (Program 2) is also included. Use "The Automatic Proofreader" found elsewhere in this issue to insure accurate typing when entering these two programs. The ML routine for Crystal Clear is very short—only 481 bytes long. It resides in locations 49152–49633.

Using Crystal Clear

First, read the machine language into memory at the beginning of your program (see Program 1). Whenever you wish to use the routine, you must use three POKEs to specify the speed, character, and color; and you must use a SYS to call the routine. The speed is controlled by POKEing location 780 with a number from 0 to 255. Zero is full speed, and 255 is a slow crawl. Location 781 controls the print character. You must POKE this location with the screen code of the character that you wish to use. You can use any available character. Many of the Commodore graphics characters produce pleasing displays. If you do not wish to use a character, but simply want to clear the screen using the effect of a pattern, POKE location 781 with 32 (space). The color is changed by POKEing 782 with a color number from 0 to 16.

After the speed, character, and color have been set, you must choose one of the ten patterns as shown in the accompanying figure. Now, to clear the screen, simply SYS to the location that corresponds to the desired pattern.

Many combinations and effects are possible when using these clear-screen routines. You can use several routines back-to-back by simply calling the routine more than once. Remember, what we normally think of as a clear screen is really a screen full of spaces.

Experiment with loops to produce dazzling effects, or fill the screen with a character to produce a backdrop for a title screen or game. Run the demo (Program 2) to see just some of the effects possible.

See program listings on page 101.

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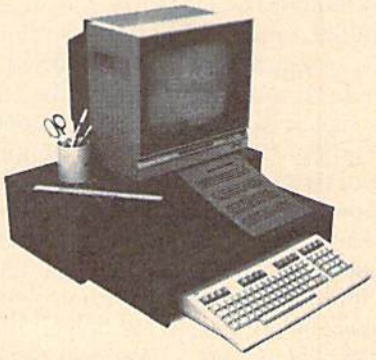

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Rhett Anderson and David Hensley, Jr.

This month, we'll look at how "GeoPuzzle," the game presented in the October issue, was programmed. A full listing of the machine language source code is included.

By the time you read this, it's likely that Berkeley Softworks' *GeoProgrammer* machine language development package will be released, making it easier to program *GEOS* applications. However, it is possible to write machine language *GEOS* applications on standard 64 assemblers. In the case of "GeoPuzzle," we used *Pal*, an assembler from Proline Software.

The first problem a machine language programmer has when moving to *GEOS* is the lack of adequate documentation. While the 64 is a mature machine supported by superb tools, software, books, and magazines, *GEOS* is a newcomer. Perhaps the best source of information comes from Berkeley Softworks itself. Berkeley's book, *The Official GEOS Programmer's Reference Guide*, was an invaluable reference for us. Also of assistance were two COMPUTE! Books, *Mapping the 64 & 64C* and the revised edition of *Programming the 64*. Each of these books contains a memory map of *GEOS* and discussions of the various system functions—but without Berkeley's book, programming a complete application would be nearly impossible. (Note that Berkeley's reference guide contains several serious factual and typographical errors; however, a revised edition is in the works).

At The Source

Examine the GeoPuzzle source code listing. After the program sets up the screen and icons, it effectively stops running. But *GEOS* keeps working in the background, moni-

GeoPuzzle Source Code

```
10 OPEN2,8,1,"0:GEOPUZZLE"
20 SYS 700
30 .OPT O2,P
40 ;
50 ;
60 ;GEOPUZZLE
70 ;
80 ;BY RHETT ANDERSON & DAVID HENSLEY JR
90 ;
100 ;COPYRIGHT 1987 COMPUTE! PUBLICATIONS, INC.
110 ;ALL RIGHTS RESERVED
120 ;
130 ;PAL FORMAT
140 ;
150 ;
160 *= $304
170 ;
180 ; WE START AT $304 TO INSURE THE
190 ; ACTUAL GEOS CODE STARTS AT $400
200 ;
210 .BYTE (63+$80) ; ADD 80 FOR
220 ; UNCOMPRESSED SPRITE DATA
230 .BYTE 0,0,0
240 .BYTE 255,255,254
250 .BYTE 128,0,2
260 .BYTE 159,125,242
270 .BYTE 159,69,242
280 .BYTE 159,69,242
290 .BYTE 159,125,242
300 .BYTE 128,0,2
310 .BYTE 159,125,242
320 .BYTE 145,85,18
330 .BYTE 145,85,18
340 .BYTE 159,125,242
350 .BYTE 128,0,2
360 .BYTE 159,125,242
370 .BYTE 159,69,242
380 .BYTE 159,69,242
390 .BYTE 159,125,242
400 .BYTE 128,0,2
410 .BYTE 255,255,254
420 .BYTE 0,0,0
430 .BYTE 0,0,0
440 .BYTE $80+3
450 .BYTE 6
460 .BYTE 0
470 .WORD $400
480 .WORD ENDCODE
490 .WORD $400
500 .ASC "GEOPUZZLE   V1.0"
510 .BYTE 0,0,0,0
520 .ASC "ANDERSON & HENSLEY"
530 .BYTE 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
540 ;
550 ; GEOS EQUATES
560 ;
570 SETPATTERN = $C139
580 NEWDISK = $C1E1
590 IRECTANGLE = $C19F
```

toring mouse movements and clicks. When an icon has been selected, *GEOS* gives control to the routine corresponding to that icon.

Initialization is done in lines 680–990. The board and icons are drawn, and then the program ends via an RTS.

The icon table begins at line 1050. First, the number of icons is specified. Of the 14 icons we used, the first 12 are the arrows used to move the board's squares. The other two are the special purpose icons used to "fix" the puzzle and to return to the *GEOS* deskTop.

The next two values in the table (160 and 100) give the location that the mouse pointer should be placed after the icons are drawn. The 14 icon definitions follow, each specifying the address of the image for the icon, position for the icon, size of the icon, and address of the icon's service routine. This service routine is what *GEOS* executes when you click on the icon.

All icon images are in compressed *GEOS* format. This format is discussed in all three of the books mentioned above. To avoid compressing the images, we added 128 ($80) to the number of bytes in the image.

The Header

Looking at the source code, most programmers would be perplexed by the first part of the program, located between lines 210 and 530. This section of code will be detached from the program and placed in a "side-sector" that *GEOS* uses to store information about the application. It is critical that this section of the program is entered exactly as listed. If one byte is missing or an extra one is added, the sector will either not be filled, or it will spill over into the main code.

To *GEOS*

When you're writing a *GEOS* application, you can't simply assemble it and then try it out. Instead, you must follow this procedure:

- Assemble the program to disk.
- Convert the object code file to *GEOS* format.
- Boot *GEOS*.
- Click on the proper icon from the *GEOS* deskTop.

Of course, you don't need to

```
600 IPUTSTRING = $C1AE
610 R0 = 2
620 MOUSEUP = $C18A
630 ENTERDESK = $C22C
640 DOICONS = $C15A
650 ;
660 ZTEMP = $70
670 ;
680 *= $400
690 JSR NEWDISK ;STOP DRIVE MOTOR
700 JSR MOUSEUP ;ACTIVATE MOUSE
710 LDA #20     ;DRAW SCREEN
720 JSR SETPATTERN
730 JSR IRECTANGLE
740 .BYTE 0,199
750 .WORD 0,319
760 LDA #1
770 JSR SETPATTERN
780 JSR IRECTANGLE
790 .BYTE 32,167
800 .WORD 32,231
810 JSR DOBACKCOLOR
820 JSR DRAWBLOCKS
830 JSR IPUTSTRING
840 .WORD 104
850 .BYTE 18
860 .ASC "GEOPUZZLE"
870 .BYTE 0
880 JSR IPUTSTRING
890 .WORD 10
900 .BYTE 188
910 .ASC "COPYRIGHT 1987 COMPUTE! PUBLICATIONS,"
920 .ASC " INC. - ALL RIGHTS RESERVED"
930 .BYTE 0
940 LDA #<GAMEICONS
950 STA R0
960 LDA #>GAMEICONS
970 STA R0+1
980 JSR DOICONS
990 RTS
1000 ;
1010 DOIT JSR DOBACKCOLOR : JMP ENTERDESK
1020 ;
1030 ;THE ICON TABLE
1040 ;
1050 GAMEICONS .BYTE 14
1060 .WORD 160
1070 .BYTE 100
1080 ;
1090 BUTTON1 .WORD DOWNARROW
1100 .BYTE 10,42
1110 .BYTE 1,8
1120 .WORD DOROT0
1130 ;
1140 BUTTON2 .WORD DOWNARROW
1150 .BYTE 15,42
1160 .BYTE 1,8
1170 .WORD DOROT1
1180 ;
1190 BUTTON3 .WORD DOWNARROW
1200 .BYTE 20,42
1210 .BYTE 1,8
1220 .WORD DOROT2
1230 ;
1240 BUTTON4 .WORD UPARROW
1250 .BYTE 10,151
1260 .BYTE 1,8
1270 .WORD DOROT3
1280 ;
1290 BUTTON5 .WORD UPARROW
1300 .BYTE 15,151
1310 .BYTE 1,8
1320 .WORD DOROT4
```

type in the program listed to use GeoPuzzle. A much easier way to get the game is to type in the MLX listing from last month's issue. However, if you're interested in writing a *GEOS* application, you'll find that the source code listing provided here is just the "skeleton" you need to develop your own *GEOS* programs.

```
1330 ;
1340 BUTTON6 .WORD UPARROW
1350 .BYTE 20,151
1360 .BYTE 1,8
1370 .WORD DOROT5
1380 ;
1390 BUTTON7 .WORD RIGHTARROW
1400 .BYTE 6,65
1410 .BYTE 1,8
1420 .WORD DOROT6
1430 ;
1440 BUTTON8 .WORD RIGHTARROW
1450 .BYTE 6,97
1460 .BYTE 1,8
1470 .WORD DOROT7
1480 ;
1490 BUTTON9 .WORD RIGHTARROW
1500 .BYTE 6,129
1510 .BYTE 1,8
1520 .WORD DOROT8
1530 ;
1540 BUTTON10 .WORD LEFTARROW
1550 .BYTE 25,65
1560 .BYTE 1,8
1570 .WORD DOROT9
1580 ;
1590 BUTTON11 .WORD LEFTARROW
1600 .BYTE 25,97
1610 .BYTE 1,8
1620 .WORD DOROT10
1630 ;
1640 BUTTON12 .WORD LEFTARROW
1650 .BYTE 25,129
1660 .BYTE 1,8
1670 .WORD DOROT11
1680 ;
1690 BUTTON13 .WORD WRENCH
1700 .BYTE 33,70
1710 .BYTE 3,21
1720 .WORD DOWRENCH
1730 ;
1740 BUTTON14 .WORD GEOS
1750 .BYTE 33,110
1760 .BYTE 3,21
1770 .WORD DOIT
1780 ;
1790 ;ICON IMAGES
1800 ;
1810 DOWNARROW .BYTE 128+8
1820 .BYTE 24,24,24,24,255,
     126,60,24
1830 ;
1840 UPARROW .BYTE 128+8
1850 .BYTE 24,60,126,255,24,
     24,24,24
1860 ;
1870 LEFTARROW .BYTE 128+8
1880 .BYTE 16,48,112,255,255,
     112,48,16
1890 ;
1900 RIGHTARROW .BYTE 128+8
1910 .BYTE 8,12,14,255,255,14,12,8
1920 ;
1930 DRAWBLOCKS LDX PPOINT : LDA PAT0,X
1940 JSR SETPATTERN
1950 JSR IRECTANGLE
1960 .BYTE 56,79
1970 .WORD 72,103
1980 LDX PPOINT+1 : LDA PAT0,X
1990 JSR SETPATTERN
2000 JSR IRECTANGLE
2010 .BYTE 56,79
2020 .WORD 112,143
2030 LDX PPOINT+2 : LDA PAT0,X
2040 JSR SETPATTERN
2050 JSR IRECTANGLE
2060 .BYTE 56,79
2070 .WORD 152,183
2080 LDX PPOINT+3 : LDA PAT0,X
2090 JSR SETPATTERN
2100 JSR IRECTANGLE
2110 .BYTE 88,111
2120 .WORD 72,103
2130 LDX PPOINT+4 : LDA PAT0,X : JSR SETPATTERN
2140 JSR IRECTANGLE
2150 .BYTE 88,111
2160 .WORD 112,143
2170 LDX PPOINT+5 : LDA PAT0,X : JSR SETPATTERN
2180 JSR IRECTANGLE
2190 .BYTE 88,111
2200 .WORD 152,183
2210 LDX PPOINT+6 : LDA PAT0,X : JSR SETPATTERN
2220 JSR IRECTANGLE
2230 .BYTE 120,143
2240 .WORD 72,103
2250 LDX PPOINT+7 : LDA PAT0,X : JSR SETPATTERN
2260 JSR IRECTANGLE
2270 .BYTE 120,143
2280 .WORD 112,143
2290 LDX PPOINT+8 : LDA PAT0,X : JSR SETPATTERN
2300 JSR IRECTANGLE
2310 .BYTE 120,143
2320 .WORD 152,183
2330 JSR DOCOLORS
2340 RTS
2350 ;
2360 PPOINT .BYTE 0,1,2,3,4,5,6,7,8
2370 PAT0 .BYTE 29
2380 PAT1 .BYTE 30
2390 PAT2 .BYTE 29
2400 PAT3 .BYTE 30
2410 PAT4 .BYTE 24
2420 PAT5 .BYTE 30
2430 PAT6 .BYTE 29
2440 PAT7 .BYTE 30
2450 PAT8 .BYTE 29
2460 ;
2470 ;DEFINITIONS FOR THE LARGE ICONS
2480 ;
2490 WRENCH .BYTE 128+63,0,0,0,255,255,254,128,0
2500 .BYTE 2,159,125,242,159,69,242,159
2510 .BYTE 69,242,159,125,242,128,0,2
2520 .BYTE 159,125,242,145,85,18,145,85
2530 .BYTE 18,159,125,242,128,0,2,159
2540 .BYTE 125,242,159,69,242,159,69,242
2550 .BYTE 159,125,242,128,0,2,255,255
2560 .BYTE 254,0,0,0,0,0,0,0
2570 GEOS .BYTE 128+63,0,0,0,255,255,254,131,199
2580 .BYTE 130,135,79,194,142,125,226,156
2590 .BYTE 3,242,156,3,242,188,7,250
2600 .BYTE 190,7,250,190,115,250,191,123
2610 .BYTE 250,190,63,250,188,15,250,156
2620 .BYTE 7,242,158,7,242,143,15,226
```

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```
2630 .BYTE 135,159,194,131,223,130,255,255
2640 .BYTE 254,0,0,0,0,0,0,4
2650 ;
2660 DOROT0 LDA PPOINT : LDX PPOINT+3 : LDY PPOINT+6
2670 STA PPOINT+3 : STX PPOINT+6 : STY PPOINT
2680 JMP DRAWBLOCKS
2690 DOROT1 LDA PPOINT+1 : LDX PPOINT+4 : LDY PPOINT+7
2700 STA PPOINT+4 : STX PPOINT+7 : STY PPOINT+1
2710 JMP DRAWBLOCKS
2720 DOROT2 LDA PPOINT+2 : LDX PPOINT+5 : LDY PPOINT+8
2730 STA PPOINT+5 : STX PPOINT+8 : STY PPOINT+2
2740 JMP DRAWBLOCKS
2750 DOROT3 LDA PPOINT+0 : LDX PPOINT+3 : LDY PPOINT+6
2760 STA PPOINT+6 : STX PPOINT+0 : STY PPOINT+3
2770 JMP DRAWBLOCKS
2780 DOROT4 LDA PPOINT+1 : LDX PPOINT+4 : LDY PPOINT+7
2790 STA PPOINT+7 : STX PPOINT+1 : STY PPOINT+4
2800 JMP DRAWBLOCKS
2810 DOROT5 LDA PPOINT+2 : LDX PPOINT+5 : LDY PPOINT +8
2820 STA PPOINT+8 : STX PPOINT+2 : STY PPOINT+5
2830 JMP DRAWBLOCKS
2840 DOROT6 LDA PPOINT+0 : LDX PPOINT+1 : LDY PPOINT+2
2850 STA PPOINT+1 : STX PPOINT+2 : STY PPOINT+0
2860 JMP DRAWBLOCKS
2870 DOROT7 LDA PPOINT+3 : LDX PPOINT+4 : LDY PPOINT+5
2880 STA PPOINT+4 : STX PPOINT+5 : STY PPOINT+3
2890 JMP DRAWBLOCKS
2900 DOROT8 LDA PPOINT+6 : LDX PPOINT+7 : LDY PPOINT+8
2910 STA PPOINT+7 : STX PPOINT+8 : STY PPOINT+6
2920 JMP DRAWBLOCKS
2930 DOROT9 LDA PPOINT+0 : LDX PPOINT+1 : LDY PPOINT+2
2940 STA PPOINT+2 : STX PPOINT+0 : STY PPOINT+1
2950 JMP DRAWBLOCKS
2960 DOROT10 LDA PPOINT+3 : LDX PPOINT+4 : LDY PPOINT+5
2970 STA PPOINT+5 : STX PPOINT+3 : STY PPOINT+4
2980 JMP DRAWBLOCKS
2990 DOROT11 LDA PPOINT+6 : LDX PPOINT+7 : LDY PPOINT+8
3000 STA PPOINT+8 : STX PPOINT+6 : STY PPOINT+7
3010 JMP DRAWBLOCKS
3020 DOWRENCH LDX #8
3030 LOOPW TXA : STA PPOINT,X : DEX : BPL LOOPW
3040 JMP DRAWBLOCKS
3050 ;
3060 DOBACKCOLOR LDX #250
3070 LDA #14
3080 COLOOP STA $8C00-1,X
3090 STA $8C00+249,X
3100 STA $8C00+499,X
3110 STA $8C00+749,X
3120 DEX
3130 BNE COLOOP
3140 RTS
3150 DOCOLORS LDY #8
3160 BIGLOOP LDA PPOINT,Y
3170 TAX
3180 LDA LTHEADD,Y
3190 STA ZTEMP
3200 LDA HTHEADD,Y
3210 STA ZTEMP+1
3220 TYA
3230 PHA
3240 LDY #0
3250 LDA COL0,X
3260 STA (ZTEMP),Y
3270 INY : STA (ZTEMP),Y : INY
3280 LDA COL1,X
3290 STA (ZTEMP),Y : INY : STA (ZTEMP),Y
3300 LDY #80
3310 LDA COL2,X
3320 STA (ZTEMP),Y
3330 INY : STA (ZTEMP),Y : INY
3340 LDA COL3,X
3350 STA (ZTEMP),Y : INY : STA (ZTEMP),Y
```

```
3360 PLA
3370 TAY
3380 DEY
3390 BPL BIGLOOP
3400 RTS
3410 ;
3420 LTHEADD .BYTE <(7*40+$8C00+9)
3430 .BYTE <(7*40+$8C00+14)
3440 .BYTE <(7*40+$8C00+19)
3450 .BYTE <(11*40+$8C00+9)
3460 .BYTE <(11*40+$8C00+14)
3470 .BYTE <(11*40+$8C00+19)
3480 .BYTE <(15*40+$8C00+9)
3490 .BYTE <(15*40+$8C00+14)
3500 .BYTE <(15*40+$8C00+19)
3510 HTHEADD .BYTE >(7*40+$8C00+9)
3520 .BYTE >(7*40+$8C00+14)
3530 .BYTE >(7*40+$8C00+19)
3540 .BYTE >(11*40+$8C00+9)
3550 .BYTE >(11*40+$8C00+14)
3560 .BYTE >(11*40+$8C00+19)
3570 .BYTE >(15*40+$8C00+9)
3580 .BYTE >(15*40+$8C00+14)
3590 .BYTE >(15*40+$8C00+19)
3600 COL0 .BYTE 14,14,14,14,7,5,14,2,4
3610 COL1 .BYTE 14,14,14,7,5,14,2,4,14
3620 COL2 .BYTE 14,7,5,14,2,4,14,14,14
3630 COL3 .BYTE 7,5,14,2,4,14,14,14,14
3640 ENDCODE .BYTE 0
```


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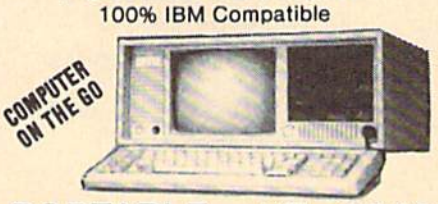

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BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," elsewhere in this issue.

Sketch Pad

Article on page 40.

Program 1: Sketch Pad—Main Menu

```
KC 10 REM COPYRIGHT 1987 COMPU
      TE! PUBLICATIONS, INC. -
      ALL RIGHTS RESERVED
CB 20 IFL>0THEN60
MH 30 POKE52,32:POKE56,32:POKE
      252,0:CLR
AM 40 PRINT"{CLR}{BLU}
      {3 SPACES}COPYRIGHT 1987
      COMPUTE! PUB., INC."
PA 50 PRINTTAB(10)"ALL RIGHTS
      {SPACE}RESERVED"
QJ 60 GOSUB130
QJ 70 GOSUB300
EM 80 IFCM=7THEN110
BJ 90 POKE845,PR(1)+1:POKE846,
      PR(2)+1:POKE53287,PR(1):
      SYS32768
SP 100 GOTO70
PM 110 INPUT"{CLR}EXIT (Y/N)";
      FC$:IFFC$<>"Y"THEN70
GP 120 PRINT"{CLR}PROCESSING C
      OMPLETE":POKE251,0:END
QX 130 IFPEEK(251)=86THENPOKE8
      39,0:GOTO190
BH 140 IFL=0THENL=1:LOAD"SKETC
      H-PAD",8,1
RE 150 IFL=1THENL=2:LOAD"SAVES
      KETCH",8,1
MK 160 IFL=2THENL=3:LOAD"PRINT
      SKETCH",8,1
QB 170 FORC1=1TO128:READSP:POK
      E16255+C1,SP:NEXT
BM 180 POKE839,1:POKE833,1:POK
      E840,50
BG 190 CM$(1)="PAINT COLOR":PR
      (1)=0
FD 200 CM$(2)="BACKGROUND COLO
      R":PR(2)=14
RD 210 CM$(3)="SAVE SKETCH"
AX 220 CM$(4)="SAVE TRANSFER"
RJ 230 CM$(5)="LOAD SKETCH"
MM 240 CM$(6)="LOAD TRANSFER"
DQ 250 CM$(7)="EXIT TO BASIC"
PC 260 IFPEEK(251)<>86THENCM=1
CF 270 POKE251,86
FG 280 BA=27998:POKE878,PEEK(B
      A):POKE879,PEEK(BA+1)
SK 290 RETURN
DK 300 POKE53280,6:POKE53281,6
      :PRINT"{CLR}{CYN}"
GD 310 PRINT"{HOME}"TAB(15)"
      {BLK}SKETCH PAD{2 DOWN}
      "
GR 320 IFCM=0THENCM=1
EH 330 FORC1=1TO7:PRINT" "
EB 340 IFC1<3THENPRINTTAB(20);
      :FORD=1TO16:POKE646,D:P
      RINT"{RVS} {OFF}";:NEXT
      :PRINT:GOTO360
MQ 350 PRINT" "
DE 360 PRINT"{CYN}";:IFC1=CMTH
      ENPRINT"{RVS}";
HC 370 PRINTCM$(C1)
FK 380 NEXT
FP 390 PRINT"{HOME}{14 DOWN}"
RS 400 PRINTTAB(24)"{BLK}F1-SK
      ETCH{3 DOWN}"
GE 410 PRINTTAB(24)"F7-PRINT
      {CYN}"
GQ 420 GOSUB930
HJ 430 GETFC$
BA 440 IFFC$="{F1}"THENIFCM=7T
      HENCM=1
XX 450 IFFC$="{F1}"THEN920
GF 460 IFFC$="{F7}"THENGOSUB10
      40:GOTO300
QQ 470 IFPEEK(56320)=127THEN43
      0
HK 480 J1=PEEK(56320)
FC 490 IF(J1OR239)=239THEN630
RF 500 IF(J1OR247)=247THEN610
RF 510 IF(J1OR251)=251THEN580
DG 520 IF(J1OR253)=253THEN560
XH 530 IF(J1OR254)<>254THEN430
CC 540 CM=CM-1:IFCM<1THENCM=7
BE 550 GOTO310
QD 560 CM=CM+1:IFCM>7THENCM=1
KG 570 GOTO310
CS 580 IFCM>2THEN430
QJ 590 PR(CM)=PR(CM)-1:IFPR(CM
      )<0THENPR(CM)=15
HJ 600 GOTO420
XX 610 PR(CM)=PR(CM)+1:IFPR(CM
      )>15THENPR(CM)=0
XM 620 GOTO420
CG 630 IFCM=7THEN920
QQ 640 IFCM<3THEN430
BR 650 PRINT"{CLR}";CM$(CM);"
      {2 DOWN}":FC$=""
PJ 660 INPUT"FILE NAME";FC$:IF
      FC$=""THEN300
BC 670 IFCM=3ORCM=5THENFC$="SP
      ."+LEFT$(FC$,12)
CD 680 IFCM=4ORCM=6THENFC$="SX
      ."+LEFT$(FC$,12)
HH 690 OPEN15,8,15
FH 700 OPEN2,8,2,FC$+",P,R":IN
      PUT#15,E,E$
JE 710 CLOSE2:CLOSE15
DJ 720 IFE>0THENIFCM>4THEN870
QK 730 IFE=0THENIFCM<5THEN870
JS 740 IFCM>4THENLOADFC$,8,1
PR 750 PK=17950:POKEPK,(LEN(FC
      $))
CC 760 PRINT"{3 DOWN}SAVING ";
      FC$;"{3 DOWN}"
CH 770 IFCM=3THENBA=8192:EA=BA
      +8000
SK 780 IFCM=4THENBA=27998:EA=B
      A+INT((PEEK(878)/8)*PEE
      K(879))+10
GC 790 BH=INT(BA/256):BL=BA-(B
      H*256)
JD 800 EH=INT(EA/256):EL=EA-(E
      H*256)
QX 810 POKE18030,BL:POKE18034,
      BH:POKE18038,EL:POKE180
      40,EH
HQ 820 FORC1=1TOLEN(FC$):POKEP
      K+C1,ASC(MID$(FC$,C1,1)
      ):NEXT
AM 830 IFCM=4THENPOKEBA,PEEK(8
      78):POKEBA+1,PEEK(879)
JD 840 SYS18000
ME 850 IFPEEK(PK)=0THEN300
RX 860 PRINT"BAD SAVE{3 DOWN}"
      :GOTO880
SK 870 PRINTE;E$;"{3 DOWN}"
DR 880 PRINT"PRESS RETURN TO C
      ONTINUE"
RB 890 GETFC$:IFFC$<>""THEN890
SC 900 GETFC$:IFFC$=""THEN900
KP 910 GOTO300
XS 920 RETURN
GH 930 PRINT"{HOME}{4 DOWN}"
HJ 940 PRINTTAB(20);
GG 950 FORC1=0TO15:IFC1=PR(1)T
      HENPRINT"↑";:GOTO970
HS 960 PRINT" ";
FS 970 NEXT
QK 980 PRINT"{2 DOWN}"
DQ 990 PRINTTAB(20);
KG 1000 FORC1=0TO15:IFC1=PR(2)
      THENPRINT"↑";:GOTO1020
JB 1010 PRINT" ";
BA 1020 NEXT
SB 1030 RETURN
XQ 1040 PRINT"{CLR}SKETCH PRIN
      T PROCESS{3 DOWN}"
BP 1050 PRINT"PRINT PICTURE
      {RVS}L{OFF}-LARGE OR
      {RVS}S{OFF}-SMALL?"
KS 1060 GETFC$:IFFC$<>""THEN10
      60
BH 1070 GETFC$:IFFC$=""THEN107
      0
XP 1080 IFFC$="L"THENPOKE49220
      ,0:GOTO1110
MD 1090 IFFC$="S"THENPOKE49220
      ,1:GOTO1110
XC 1100 GOTO1120
DD 1110 SYS49300
HH 1120 RETURN
QX 1130 DATA0,0,0,0,0,0,0,0
KS 1140 DATA0,0,0,0,0,0,0,0
FM 1150 DATA0,0,0,0,0,255,128,
      0
HD 1160 DATA160,192,0,160,224,
      0,160,192
HE 1170 DATA0,255,128,0,0,0,0,
      0
QD 1180 DATA0,0,0,0,0,0,0,0
PC 1190 DATA0,0,0,0,0,0,0,0
BA 1200 DATA0,0,0,0,0,0,0,128
KC 1210 DATA0,0,0,0,0,0,0,0
EC 1220 DATA0,0,0,0,0,0,0,0
XX 1230 DATA0,0,0,0,0,0,3,255
EE 1240 DATA0,6,5,0,14,5,0,6
JC 1250 DATA5,0,3,255,0,0,0,0
JG 1260 DATA0,0,0,0,0,0,0,0
HG 1270 DATA0,0,0,0,0,0,0,0
KS 1280 DATA0,0,0,0,0,0,0,128
```

Program 2: Sketch Pad—Plotting Routines

See instructions in article on page 40 before typing in.

```
8000:AD 15 D0 09 01 8D 15 D0 01
8008:AD 18 D0 09 08 8D 18 D0 08
8010:AD 11 D0 09 20 8D 11 D0 01
8018:A5 02 8D 50 03 A5 03 8D 65
8020:51 03 A5 3F 8D 6B 03 A5 F8
8028:40 8D 6C 03 A9 00 8D 6D 40
8030:03 8D 74 03 A9 01 8D 75 B6
8038:03 8D 76 03 20 DA 8A A9 48
8040:00 85 02 A9 20 85 03 A9 44
8048:20 85 3F A9 4E 85 40 A0 E6
8050:00 AD 47 03 D0 0A AD 6D 4D
8058:03 F0 09 B1 3F 4C 62 80 C3
8060:A9 00 91 02 B1 02 91 3F 80
8068:A5 02 18 69 01 85 02 A5 1E
8070:03 69 00 85 03 A5 3F 18 EA
8078:69 01 85 3F A5 40 69 00 14
8080:85 40 A5 03 C9 3F D0 C9 EF
8088:A5 02 C9 40 D0 C3 A9 00 03
8090:85 02 A9 04 85 03 AD 4D 2B
8098:03 0A 0A 0A 0A 0D 4E 03 A3
80A0:8D 4F 03 AD 4E 03 8D 20 31
80A8:D0 A0 00 A2 03 AD 4F 03 D4
80B0:91 02 E6 02 D0 05 E6 03 63
80B8:4C AD 80 A5 03 C9 07 D0 D3
80C0:EC A5 02 C9 E8 D0 E6 AD 84
80C8:6D 03 F0 05 A9 01 8D 47 63
80D0:03 AD 47 03 D0 11 AD 77 75
80D8:03 C9 4D D0 0A AD 52 03 33
80E0:85 02 AD 53 03 85 03 AD F1
80E8:77 03 C9 4D F0 08 A9 4D BC
80F0:8D 77 03 4C FB 80 AD 47 40
```

```
80F8:03 F0 5F A9 80 8D 3F 03 F9
8100:A9 00 8D 45 03 8D 47 03 BD
8108:85 02 A9 20 85 03 A9 FE 10
8110:8D F8 07 A9 01 8D 43 03 5B
8118:8D 49 03 8D 4B 03 8D 15 04
8120:D0 8D 00 D0 8D 01 D0 A9 B7
8128:00 8D 4A 03 8D 10 D0 AD 04
8130:9E 3F 09 18 8D 9E 3F AD 08
8138:E0 3F 09 18 8D E0 3F A9 36
8140:64 8D 44 03 CE 44 03 F0 10
8148:09 20 A9 83 20 57 84 4C F8
8150:44 81 A9 00 8D 6D 03 8D C0
8158:47 03 20 3F 94 AD 00 DC EF
8160:8D 3E 03 29 10 F0 08 A9 AA
8168:01 8D 46 03 4C 90 81 CE BE
8170:46 03 AD 46 03 D0 19 A9 A8
8178:64 8D 46 03 AD 45 03 C9 5C
8180:00 F0 08 A9 00 8D 45 03 1F
8188:4C 90 81 A9 01 8D 45 03 6C
8190:AD 45 03 F0 13 A9 BE 8D 75
8198:98 3F 8D 9E 3F A9 7D 8D 7C
81A0:DA 3F 8D E0 3F 4C B8 81 BE
81A8:A9 A0 8D 98 3F 8D 9E 3F 90
81B0:A9 05 8D DA 3F 8D E0 3F 5A
81B8:AD 41 03 F0 0D A9 A0 8D 30
81C0:9B 3F A9 05 8D DD 3F 4C 95
81C8:D2 81 A9 00 8D 9B 3F 8D B1
81D0:DD 3F AD 3E 03 29 08 D0 C9
81D8:03 20 A9 83 AD 3E 03 29 68
81E0:04 D0 03 20 E7 83 AD 3E 63
81E8:03 29 01 D0 03 20 25 84 4C
81F0:AD 3E 03 29 02 D0 03 20 C6
81F8:57 84 20 D3 93 A5 C6 C9 94
8200:00 D0 03 4C 5A 81 20 E4 5C
8208:FF C9 BF F0 50 C9 4F F0 BF
8210:61 C9 43 F0 60 C9 46 F0 57
8218:47 C9 41 F0 46 C9 44 F0 3D
8220:45 C9 45 F0 44 C9 42 F0 B0
8228:43 C9 85 F0 42 C9 58 F0 DB
8230:4D C9 53 F0 60 C9 4E F0 7F
8238:4B C9 4D F0 4D C9 2D F0 EA
8240:37 C9 2B F0 36 C9 4C F0 2A
8248:52 C9 52 F0 59 C9 54 F0 CD
8250:60 A6 FC E0 56 D0 03 20 F8
8258:EC C2 4C 5A 81 4C 60 83 35
8260:4C E3 82 4C E9 82 4C 31 BC
8268:83 4C 39 83 4C 41 83 4C 5C
8270:75 83 4C FB 82 4C 16 83 4F
8278:4C B7 82 4C CD 82 20 8E ED
8280:84 4C 5A 81 20 2A 85 4C 3F
8288:5A 81 A9 01 8D 74 03 20 C4
8290:2A 85 4C 5A 81 20 20 86 8E
8298:4C 5A 81 A9 00 8D EE 03 3C
82A0:20 BF 8C 4C 5A 81 A9 01 29
82A8:8D EE 03 20 BF 8C 4C 5A B5
82B0:81 20 30 91 4C 5A 81 AD 1A
82B8:48 03 18 69 0A 8D 48 03 56
82C0:18 C9 0A B0 05 A9 FF 4C AB
82C8:BD 82 4C 5A 81 AD 48 03 D2
82D0:38 E9 0A 8D 48 03 18 C9 CE
82D8:F5 90 05 A9 01 4C D3 82 9B
82E0:4C 5A 81 20 7D 88 4C 5A D5
82E8:81 EE 27 D0 AD 27 D0 C9 D1
82F0:10 D0 05 A9 00 8D 27 D0 C2
82F8:4C 5A 81 A2 00 8E 15 D0 4A
8300:20 E4 FF F0 F6 A2 01 8E 32
8308:15 D0 C9 4F D0 EA A9 01 82
8310:8D 6D 03 4C 3F 80 A2 00 9F
8318:8E 15 D0 20 E4 FF F0 F6 C7
8320:A2 01 8E 15 D0 C9 43 D0 E0
8328:CF A9 01 8D 47 03 4C 3F 98
8330:80 A9 01 8D 41 03 4C 5A E3
8338:81 A9 00 8D 41 03 4C 5A 4C
8340:81 A9 00 8D 45 03 A9 01 D5
8348:8D 67 03 EE 54 03 AD 54 9D
8350:03 C9 06 D0 05 A9 00 8D 75
8358:54 03 20 DA 8A 4C 5A 81 B7
8360:AD 67 03 F0 0B A9 00 8D 14
8368:67 03 20 DA 8A 4C 5A 81 51
8370:A9 01 4C 67 83 A9 00 8D DC
8378:15 D0 A5 02 8D 52 03 A5 74
8380:03 8D 53 03 AD 50 03 85 41
8388:02 AD 51 03 85 03 AD 6B 55
8390:03 85 3F AD 6C 03 85 40 F7
8398:AD 18 D0 29 F7 8D 18 D0 20
83A0:AD 11 D0 29 DF 8D 11 D0 97
83A8:60 AD 4A 03 F0 07 AD 49 0D
83B0:03 C9 40 F0 31 AD 49 03 98
83B8:18 69 01 8D 49 03 AD 4A 1B
83C0:03 69 00 8D 4A 03 AD 3F 75
83C8:03 4A C9 00 F0 06 8D 3F 17
83D0:03 4C E6 83 A9 80 8D 3F 2B
83D8:03 A5 02 18 69 08 85 02 05
83E0:A5 03 69 00 85 03 60 AD 4F
83E8:4A 03 D0 07 AD 49 03 C9 C2
83F0:01 F0 31 AD 49 03 38 E9 66
83F8:01 8D 49 03 AD 4A 03 E9 C3
8400:00 8D 4A 03 AD 3F 03 0A 60
8408:C9 00 F0 06 8D 3F 03 4C 30
8410:24 84 A9 01 8D 3F 03 A5 A6
8418:02 38 E9 08 85 02 A5 03 70
8420:E9 00 85 03 60 AD 4B 03 52
8428:C9 01 F0 2A CE 4B 03 CE 8F
8430:43 03 D0 15 A9 08 8D 43 D2
8438:03 A5 02 38 E9 39 85 02 31
8440:A5 03 E9 01 85 03 4C 56 51
8448:84 A5 02 38 E9 01 85 02 21
8450:A5 03 E9 00 85 03 60 AD D0
8458:4B 03 C9 C8 F0 2F EE 4B FA
8460:03 EE 43 03 AD 43 03 C9 89
8468:09 D0 15 A9 01 8D 43 03 2F
8470:A5 02 18 69 39 85 02 A5 EF
8478:03 69 01 85 03 4C 8D 84 BE
8480:A5 02 18 69 01 85 02 A5 3E
8488:03 69 00 85 03 60 20 E6 86
8490:86 A5 C6 F0 03 4C 0D 86 18
8498:A9 60 85 3F A9 6D 85 40 81
84A0:A9 80 8D 71 03 A9 00 A0 C6
84A8:00 91 3F 8D 15 D0 AD 6E 8C
84B0:03 8D 72 03 AD 6F 03 8D DB
84B8:73 03 A9 00 8D 74 03 A0 56
84C0:00 B1 02 2D 3F 03 F0 07 38
84C8:B1 3F 0D 71 03 91 3F 4E 5E
84D0:71 03 D0 18 A5 3F 18 69 B2
84D8:01 85 3F A5 40 69 00 85 33
84E0:40 A9 80 8D 71 03 A9 00 48
84E8:A0 00 91 3F CE 72 03 F0 9F
84F0:06 20 A9 83 4C BF 84 AD 8A
84F8:6E 03 8D 72 03 CE 72 03 0E
8500:F0 06 20 E7 83 4C FD 84 55
8508:CE 73 03 F0 0C 20 57 84 DA
8510:AD 6E 03 8D 72 03 4C BF BE
8518:84 AD 6F 03 8D 73 03 CE FD
8520:73 03 F0 06 20 25 84 4C 0F
8528:1F 85 A9 1E 8D 15 D0 20 BD
8530:82 86 A5 C6 F0 03 4C 0D 78
8538:86 A9 60 85 3F A9 6D 85 56
8540:40 A9 80 8D 71 03 AD 6E 20
8548:03 8D 72 03 AD 6F 03 8D 75
8550:73 03 A9 01 8D 75 03 8D F0
8558:76 03 A0 00 B1 3F 2D 71 C9
8560:03 F0 07 B1 02 0D 3F 03 EA
8568:91 02 4E 71 03 D0 12 A5 C2
8570:3F 18 69 01 85 3F A5 40 13
8578:69 00 85 40 A9 80 8D 71 C8
8580:03 CE 72 03 F0 15 AD 74 EA
8588:03 F0 0A CE 75 03 D0 08 E0
8590:A9 02 8D 75 03 20 A9 83 69
8598:4C 5A 85 AD 6E 03 8D 72 F8
85A0:03 A9 01 8D 75 03 CE 72 58
85A8:03 F0 15 AD 74 03 F0 0A 8A
85B0:CE 75 03 D0 F1 A9 02 8D B5
85B8:75 03 20 E7 83 4C A6 85 E1
85C0:CE 73 03 F0 20 AD 74 03 23
85C8:F0 0A CE 76 03 D0 08 A9 25
85D0:02 8D 76 03 20 57 84 AD 54
85D8:6E 03 8D 72 03 A9 01 8D 03
85E0:75 03 4C 5A 85 AD 6F 03 5B
85E8:8D 73 03 A9 01 8D 76 03 C0
85F0:CE 73 03 F0 15 AD 74 03 FA
85F8:F0 0A CE 76 03 D0 F1 A9 29
8600:02 8D 76 03 20 25 84 4C 5B
8608:F0 85 4C 2A 85 A9 64 8D 44
8610:46 03 A9 00 8D 45 03 8D 4B
8618:74 03 A9 01 8D 15 D0 60 28
8620:20 E6 86 A5 C6 D0 50 20 5C
8628:82 86 A5 C6 D0 49 A9 01 39
8630:8D 45 03 AD 6E 03 8D 59 84
8638:03 20 A9 83 20 1D 94 CE A9
8640:59 03 D0 F5 AD 6F 03 8D F2
8648:59 03 20 57 84 20 1D 94 AF
8650:CE 59 03 D0 F5 AD 6E 03 CE
8658:8D 59 03 20 E7 83 20 1D 8F
8660:94 CE 59 03 D0 F5 AD 6F EF
8668:03 8D 59 03 20 25 84 20 74
8670:1D 94 CE 59 03 D0 F5 A9 91
8678:01 8D 15 D0 A9 00 8D 45 C6
8680:03 60 A5 C6 F0 03 4C E5 5A
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9430:02 2D 40 03 4C 3C 94 B1 0C
9438:02 0D 3F 03 91 02 60 AE C1
9440:48 03 AC 48 03 88 D0 FD 42
9448:CA D0 F7 60 00 00 00 00 10
```

Program 3: Sketch Pad—Save Routine

See instructions in article on page 40 before typing in.

```
4650:A9 05 A2 08 A0 05 20 BA DB
4658:FF AD 1E 46 A2 1F A0 46 91
4660:20 BD FF A5 02 8D 46 46 DF
4668:A5 03 8D 47 46 A9 00 85 0D
4670:02 A9 20 85 03 A2 40 A0 88
4678:3F A9 02 20 D8 FF AD 46 B9
4680:46 85 02 AD 47 46 85 03 0E
4688:20 B7 FF 8D 1E 46 20 E7 1E
4690:FF 20 CC FF 60 00 00 00 C1
```

Program 4: Sketch Pad—Print Routine

See instructions in article on page 40 before typing in.

```
C094:20 A8 C0 20 1C C1 20 E7 7A
C09C:FF AD 30 C0 85 02 AD 31 5C
C0A4:C0 85 03 60 A5 02 8D 30 CE
C0AC:C0 A5 03 8D 31 C0 A9 00 11
C0B4:8D 3C C0 A9 20 8D 3D C0 31
C0BC:A9 00 20 BD FF A9 04 A2 44
C0C4:04 A0 0F 20 BA FF 20 C0 2B
C0CC:FF 20 CC FF A2 04 20 C9 1F
C0D4:FF A9 0D 20 D2 FF A9 00 4E
C0DC:20 BD FF A9 06 A2 04 A0 DB
C0E4:06 20 BA FF 20 C0 FF 20 EC
C0EC:CC FF A2 06 20 C9 FF A9 5B
C0F4:12 20 D2 FF A9 00 20 BD 2D
C0FC:FF A9 05 A2 04 A0 05 20 80
C104:BA FF 20 C0 FF 20 CC FF 0F
C10C:A2 04 20 C9 FF A9 FE 20 47
C114:D2 FF A9 8D 20 D2 FF 60 BB
C11C:A9 19 8D 3A C0 AD 3C C0 06
C124:85 02 AD 3D C0 85 03 AD 44
C12C:44 C0 D0 06 20 14 C2 4C 9F
C134:39 C1 20 60 C1 20 CC FF F6
C13C:A2 04 20 C9 FF A9 0D 20 93
C144:D2 FF CE 3A C0 F0 14 AD 4E
C14C:3C C0 18 69 40 8D 3C C0 29
C154:AD 3D C0 69 01 8D 3D C0 26
C15C:4C 21 C1 60 A9 00 8D 3B 30
C164:C0 20 83 C1 EE 3B C0 AD 70
C16C:3B C0 C9 28 F0 10 A5 02 8E
C174:18 69 08 85 02 A5 03 69 CD
C17C:00 85 03 4C 65 C1 60 A2 1C
C184:00 A9 00 8D 46 C0 9D 32 ED
C18C:C0 E8 E0 08 D0 F8 A2 00 F6
C194:A9 80 8D 3F C0 A0 00 A9 E4
C19C:80 8D 40 C0 B1 02 2D 3F 07
C1A4:C0 F0 0C BD 32 C0 0D 40 11
C1AC:C0 9D 32 C0 8D 46 C0 C8 1A
C1B4:4E 40 C0 D0 E7 E8 4E 3F 53
C1BC:C0 D0 DA AD 46 C0 F0 03 25
C1C4:20 C8 C1 60 20 CC FF A2 9F
C1CC:05 20 C9 FF A2 00 BD 32 D6
C1D4:C0 20 D2 FF E8 E0 08 D0 C6
C1DC:F5 A9 0D 20 D2 FF 20 CC 0D
C1E4:FF A2 04 20 C9 FF AD 44 81
C1EC:C0 D0 03 4C FC C1 A2 14 72
C1F4:A9 1D 20 D2 FF CA D0 F8 8B
C1FC:AE 3B C0 F0 08 A9 1D 20 0F
C204:D2 FF CA D0 F8 A9 FE 20 E5
C20C:D2 FF A9 8D 20 D2 FF 60 B5
C214:A9 01 8D 45 C0 A9 00 8D EE
C21C:3B C0 A9 00 8D 47 C0 20 CF
C224:62 C2 AD 3B C0 C9 50 F0 B3
C22C:10 A5 02 18 69 08 85 02 5D
C234:A5 03 69 00 85 03 4C 1E 69
C23C:C2 EE 45 C0 AD 45 C0 C9 61
C244:03 F0 1A AD 3C C0 85 02 97
C24C:AD 3D C0 85 03 20 CC FF 9A
C254:A2 04 20 C9 FF A9 0D 20 AD
C25C:D2 FF 4C 19 C2 60 A2 00 43
C264:A9 00 8D 46 C0 9D 32 C0 76
C26C:E8 E0 08 D0 F8 A2 00 AD AC
C274:47 C0 D0 05 A9 80 8D 3F E1
C27C:C0 A0 00 AD 45 C0 C9 01 27
C284:F0 02 A0 04 A9 C0 8D 40 03
C28C:C0 B1 02 2D 3F C0 F0 17 E7
C294:BD 32 C0 0D 40 C0 9D 32 E0
C29C:C0 8D 46 C0 E8 BD 32 C0 1E
C2A4:0D 40 C0 9D 32 C0 CA C8 A5
C2AC:4E 40 C0 4E 40 C0 D0 D9 E6
C2B4:4E 3F C0 E8 E8 E0 08 D0 83
C2BC:C0 AD 46 C0 F0 03 20 C8 7F
C2C4:C1 EE 3B C0 EE 47 C0 AD 1E
C2CC:47 C0 C9 02 F0 03 4C 62 0E
C2D4:C2 60 00 00 00 00 00 00 D3
```

Fraction Practice II

Article on page 36.

```
KC 10 REM COPYRIGHT 1987 COMPU
      TE! PUBLICATIONS, INC. -
      ALL RIGHTS RESERVED
BM 20 IF PEEK(65530)=5 THEN BA
      NK 15
RA 30 BA=53281:BO=53280:IF PEE
      K(65530)=164 THEN BA=653
      01:BO=65305
DD 40 X=RND(-TI):DEFFNC(Z1)=IN
      T(15*RND(1))+1
RX 50 POKEBA,1:POKEBO,0:PRINTC
      HR$(142)
XG 60 PRINT"{CLR}{3 SPACES}COP
      YRIGHT 1987 COMPUTE! PUB
      ., INC."
PX 70 PRINTTAB(10)"ALL RIGHTS
      {SPACE}RESERVED{3 DOWN}"
JF 80 PRINTTAB(9)"{RVS}FRACTIO
      N PRACTICE II{OFF}
      {3 DOWN}"
XE 90 PRINTTAB(9)"WHICH OPERAT
      ION?{2 DOWN}"
RX 100 PRINTTAB(9)"1 = MULTIPL
      ICATION{DOWN}"
BM 110 PRINTTAB(9)"2 = DIVISIO
      N ";
EQ 120 INPUTM:IFM<1ORM>2THEN60
BR 130 P=0:TI$="000000":PRINT"
      {CLR}":POKEBA,4:POKEBO,
      7+5*16
MK 140 CC=0:N=0:X=FNC(Z1):Y=FN
      C(Z1):IF X=Y THEN140
QG 150 A=FNC(Z1):IF A=X OR A=Y
       THEN150
RH 160 B=FNC(Z1):IF B=A OR B=X
       OR B=Y THEN160
XM 170 P=P+1:IF P>20 THEN1640
RE 180 IF M=2 THEN GOSUB1330
AE 190 GOSUB1750
GQ 200 PRINT"{DOWN}SIMPLIFY WH
```

```
      ICH NUMBERS?"
SK 210 PRINT"(IF NONE, TYPE 1)
ME 220 INPUT S1:IF S1=1 THEN81
      0
HS 230 IF S1=E THEN190
GE 240 IF S1=X THENPRINT"
      {HOME}{3 DOWN}"TAB(2)"
      {RVS}{2 SPACES}{3 LEFT}
      "X"{OFF}{6 DOWN}":GOTO2
      90
PJ 250 IF S1=Y THENPRINT"
      {HOME}{5 DOWN}"TAB(2)"
      {RVS}{2 SPACES}{3 LEFT}
      "Y"{OFF}{4 DOWN}":GOTO2
      90
HM 260 IF S1=A THENPRINT"
      {HOME}{3 DOWN}"TAB(12)"
      {RVS}{2 SPACES}{3 LEFT}
      "A"{OFF}{6 DOWN}":GOTO2
      90
GR 270 IF S1=B THENPRINT"
      {HOME}{5 DOWN}"TAB(12)"
      {RVS}{2 SPACES}{3 LEFT}
      "B"{OFF}{4 DOWN}":GOTO2
      90
KM 280 PRINT"{2 DOWN}THERE ISN
      'T A";S1:S1=0:GOSUB1720
      :GOTO190
JM 290 INPUT S2:IF S2=E THEN19
      0
KH 300 IF S2=B THENPRINT"
      {HOME}{5 DOWN}"TAB(12)"
      {RVS}{2 SPACES}{3 LEFT}
      "B"{OFF}{4 DOWN}":GOTO3
      50
SD 310 IF S2=A THENPRINT"
      {HOME}{3 DOWN}"TAB(12)"
      {RVS}{2 SPACES}{3 LEFT}
      "A"{OFF}{6 DOWN}":GOTO3
      50
KS 320 IF S2=Y THENPRINT"
      {HOME}{5 DOWN}"TAB(2)"
      {RVS}{2 SPACES}{3 LEFT}
      "Y"{OFF}{4 DOWN}":GOTO3
      50
RP 330 IF S2=X THENPRINT"
      {HOME}{3 DOWN}"TAB(2)"
      {RVS}{2 SPACES}{3 LEFT}
      "X"{OFF}{6 DOWN}":GOTO3
      50
XK 340 PRINT"{DOWN}THERE ISN'T
       A";S2:S2=0:GOSUB1720:G
      OTO190
DH 350 IF (C>0 AND S1=S2) OR S
      1<>S2 THEN370
QH 360 PRINT"{2 DOWN}ONLY ONE
      {SPACE}"S1" CAN BE USED
       HERE":S1=0:S2=0:GOSUB1
      720:GOTO190
GE 370 IF S1=X OR S1=A THEN390
HR 380 IF S1=Y OR S1=B THEN410
RF 390 IF S2=Y OR S2=B THEN460
AP 400 GOTO420
JE 410 IF S2=X OR S2=A THEN460
PJ 420 IF S1=S2 THEN360
EB 430 PRINT"{2 DOWN}YOU CAN'T
       SIMPLIFY TWO NUMERATOR
      S OR{2 SPACES}"
GB 440 PRINT"TWO DENOMINATORS"
DA 450 S1=0:S2=0:GOSUB1720:GOT
      O190
MM 460 IF S1>S2 THEN D=S1:GOTO
      480
BK 470 D=S2
RD 480 FOR C=D TO 2 STEP -1
CJ 490 IF S1/C=INT(S1/C) AND S
      2/C=INT(S2/C) THEN530
CB 500 NEXT C
JC 510 PRINT"{2 DOWN}CAN'T SIM
      PLIFY THOSE NUMBERS":GO
      SUB1720
MC 520 S1=0:S2=0:GOTO190
PK 530 PRINT"{2 DOWN}WHAT IS T
      HE LARGEST NUMBER THAT
      {SPACE}CAN"
GP 540 PRINT"DIVIDE BOTH"S1"AN
      D"S2"?"
CB 550 INPUT C1:IF C1=E THEN19
      0
FC 560 IFC1<CTHENPRINT"{DOWN}T
      RY A LARGER NUMBER
      {7 UP}":GOTO530
HE 570 IFC1>CTHENPRINT"{DOWN}T
      OO LARGE{10 SPACES}
      {7 UP}":GOTO530
QC 580 PRINT"{DOWN}{39 SPACES}
      "
DF 590 PRINTS1"DIVIDED BY"C1"
      {SPACE}={2 SPACES}";
AR 600 INPUT C2:IF C2=E THEN19
      0
HD 610 IF C2=S1/C1 THEN630
GH 620 PRINT"INCORRECT...
      {4 UP} ":GOTO580
MM 630 PRINT"{39 SPACES}"
MB 640 IF S1=X THEN X=S1/C1:PR
      INT"{HOME}{3 DOWN} "X;"
      {LEFT}{2 SPACES}
      {15 DOWN}":GOTO680
GR 650 IF S1=A THEN A=S1/C1:PR
      INT"{HOME}{3 DOWN} "TAB
      (11)A;"{LEFT}{2 SPACES}
      {15 DOWN}":GOTO680
GA 660 IF S1=Y THEN Y=S1/C1:PR
      INT"{HOME}{5 DOWN} "Y;"
      {LEFT}{2 SPACES}
      {13 DOWN}":GOTO680
FC 670 IF S1=B THEN B=S1/C1:PR
      INT"{HOME}{5 DOWN}"TAB(
      11)S1/C1;"{LEFT}
      {2 SPACES}{13 DOWN}"
SQ 680 PRINTS2"DIVIDED BY"C1"
      {SPACE}={2 SPACES}";
FD 690 INPUT C3:IF C3=E THEN68
      0
CF 700 IF C3=S2/C1 THEN PRINT"
      {12 SPACES}":GOTO720
DH 710 PRINT"INCORRECT...
      {3 UP}":GOTO630
MP 720 IF S2=B THEN B=S2/C1:PR
      INT"{HOME}{5 DOWN}"TAB(
      11)B;"{LEFT}{2 SPACES}
      {14 DOWN}":GOTO760
BD 730 IF S2=Y THEN Y=S2/C1:PR
      INT"{HOME}{5 DOWN} "Y;"
      {LEFT}{2 SPACES}
      {14 DOWN}":GOTO760
HG 740 IF S2=A THEN A=S2/C1:PR
      INT"{HOME}{3 DOWN} "TAB
      (11)A;"{LEFT}{2 SPACES}
      {16 DOWN}":GOTO760
DM 750 IF S2=X THEN X=S2/C1:PR
      INT"{HOME}{3 DOWN} "X;"
      {LEFT}{2 SPACES}
      {16 DOWN}"
GQ 760 PRINT"{DOWN}GOOD JOB! P
      RESS ANY KEY...
BP 770 GET BB$:IF BB$=""THEN77
      0
KG 780 CC=CC+1
EM 790 GOSUB1750
AC 800 GOTO200
DM 810 GOSUB1750
JB 820 PRINT"{HOME}{6 DOWN}
      {32 SPACES}"
SC 830 PRINT"{DOWN}YOUR ANSWER
       IS..."
EJ 840 PRINTTAB(4)"{2 DOWN}CCC
      {UP}{3 LEFT}"
RA 850 PRINT"{UP}"TAB(3);:INPU
      T N1:IF N1=E THEN190
JP 860 PRINT"{UP}"TAB(2)"
      {2 SPACES}"N1"{LEFT}
      {3 SPACES}"
QM 870 PRINTTAB(5)"CC"
PR 880 PRINTTAB(3);:INPUT D1:I
      F D1=E THEN190
AH 890 PRINT"{UP}"TAB(2)"
      {2 SPACES}"D1"{LEFT}
      {3 SPACES}"
GR 900 IF N1=X*A THEN920
DM 910 PRINT"{DOWN}WRONG NUMER
      ATOR...{2 SPACES}{8 UP}
      ":GOTO830
DC 920 IF D1=Y*B THEN940
DJ 930 PRINT"{DOWN}WRONG DENOM
      INATOR...{8 UP}":GOTO83
      0
GA 940 IFN1<D1 THEN N2=N1:D2=D
      1:GOTO1160
BR 950 IFN1/D1<>INT(N1/D1)THEN
      980
JJ 960 PRINT"{DOWN}PLEASE CHAN
      GE TO A WHOLE NUMBER...
      ":PRINTTAB(7)"{4 UP} ="
      ;:INPUT W
DG 970 GOTO990
FG 980 PRINT"{DOWN}PLEASE CHAN
      GE TO A MIXED NUMBER...
      ":PRINTTAB(7)"{4 UP} ="
      ;:INPUT W
CK 990 IF W=INT(N1/D1) THEN102
      0
BA 1000 IF W=E THEN190
HE 1010 PRINT"{3 DOWN}INCORREC
      T...{4 UP}{2 LEFT}"W"
      {LEFT}{3 SPACES}":PRIN
      TTAB(9)"{UP}";:INPUTW:
      GOTO990
XS 1020 W$=STR$(W):A$=LEFT$(W$
      ,2):L=VAL(A$):N=11:GOS
      UB1790
SM 1030 IF W<10 THEN1070
FX 1040 A$=MID$(W$,3,1):L=VAL(
      A$):N=16:GOSUB1790
DK 1050 IF W<100 THEN1070
BF 1060 A$=MID$(W$,4,1):L=VAL(
      A$):N=21:GOSUB1790
JX 1070 N=N+4:IF INT(N1/D1)=N1
      /D1 THEN PRINT"{DOWN}"
      :GOTO1280
QE 1080 PRINT"{UP}"TAB(N);:INP
      UT"{UP}";N2
CB 1090 IF N2=E THEN190
CG 1100 PRINT"{UP}"TAB(N)" "N2
      "{LEFT}{3 SPACES}":PRI
      NTTAB(N+2)"CC":PRINTTA
      B(N);
HX 1110 INPUT D2:PRINT"{UP}"TA
      B(N)" "D2"{LEFT}
      {3 SPACES}"
ER 1120 IF D2=E THEN190
QD 1130 IF N2=N1-(W*D1)THEN115
      0
DA 1140 PRINT"{2 DOWN}WRONG NU
      MERATOR...{2 SPACES}
      {4 UP}": GOTO1080
DQ 1150 IF D2<>D1 THENPRINT"
      {2 DOWN}WRONG DENOMINA
      TOR...{4 UP}":GOTO1080
JD 1160 FOR G=B*Y TO 2 STEP -1
PM 1170 IFN2/G=INT(N2/G)ANDD2/
      G=INT(D2/G)THENPRINTTA
      B(8)"{2 UP}={2 SPACES}
      ":GOTO1190
PR 11?80 NEXT G:GOTO1280
DD 1190 IF N=0 THEN N=10
RD 1200 PRINT"{2 DOWN}PLEASE S
      IMPLIFY...{16 SPACES}
      {4 UP}":PRINTTAB(N+2)"
      CC{2 UP}"
AQ 1210 PRINTTAB(N);:INPUT S4:
      PRINT"{UP}"TAB(N-1)"
      {2 SPACES}"S4"{LEFT}
      {3 SPACES}"
GX 1220 IF S4=E THEN190
AC 1230 PRINT"{DOWN}"TAB(N);:I
```

```
        NPUT T2
HQ 1240 IF T2=E THEN190
QC 1250 PRINT"{UP}"TAB(N-1)"
        {2 SPACES}"T2"{LEFT}
        {2 SPACES}"
DC 1260 IF S4=N2/G AND T2=D2/G
         THEN1280
JX 1270 PRINT"{2 DOWN}INCORREC
        T...PLEASE SIMPLIFY AG
        AIN {6 UP}":GOTO1210
MD 1280 FORS=1TO3:PRINT"
        {38 SPACES}":NEXTS
AB 1290 PRINT"{3 DOWN}{RVS}WEL
        L DONE!{OFF}"
DJ 1300 T=TI+150
PP 1310 IFT>TITHEN1310
DX 1320 GOTO140
PX 1330 PRINT"{CLR}{DOWN}THIS
        {SPACE}IS PROBLEM NUMB
        ER";P;"{LEFT}."
MD 1340 PRINT"{DOWN} "XTAB(7)"
        Q"TAB(11)B
PP 1350 PRINT" CCC{2 SPACES}CC
        C{2 SPACES}CCC ="
QQ 1360 PRINT" "YTAB(7)"Q"TAB(
        11)A
EJ 1370 PRINT"{DOWN}PLEASE REW
        RITE THE PROBLEM CORRE
        CTLY
DD 1380 PRINT"{HOME}{11 DOWN}
        {SPACE}CCC{7 SPACES}CC
        C"
RS 1390 INPUT"{HOME}{10 DOWN}"
        ;X1
CS 1400 IF X1=E THEN1330
MG 1410 PRINT"{HOME}{10 DOWN}
        {SPACE}"X1"{LEFT}
        {3 SPACES}"
HR 1420 IF X1<>X THENPRINT"
        {3 DOWN}INCORRECT...":
        GOTO1390
SF 1430 PRINT"{3 DOWN}
        {16 SPACES}"
JR 1440 INPUT"{HOME}{12 DOWN}"
        ;Y1
PD 1450 IF Y1=E THEN1330
DX 1460 PRINT"{HOME}{12 DOWN}
        {SPACE}"Y1"{LEFT}
        {3 SPACES}"
FH 1470 IF Y1<>Y THENPRINT"
        {3 DOWN}INCORRECT...":
        GOTO1440
KB 1480 PRINT"{3 DOWN}
        {16 SPACES}"
CE 1490 PRINT"{HOME}{11 DOWN}"
        TAB(5);:INPUT O$
AQ 1500 O$=LEFT$(O$,1):IF O$="
        E" THEN1330
FH 1510 PRINT"{UP}"TAB(5)"
        {2 SPACES}"O$"
        {2 SPACES}"
BC 1520 IF O$<>"*" THEN PRINT"
        {2 DOWN}PLEASE USE
        {BLK}*{BLU} FOR MULTIP
        LICATION...":GOTO1490
QH 1530 PRINT"{HOME}{10 DOWN}"
        TAB(10);:INPUT A1
PS 1540 IF A1=E THEN1330
PS 1550 PRINT"{HOME}{10 DOWN}"
        TAB(9)"{2 SPACES}"A1"
        {LEFT}{3 SPACES}"
JF 1560 IF A1<>A THEN PRINT"
        {3 DOWN}INCORRECT...
        {23 SPACES}":GOTO1530
XH 1570 PRINT"{3 DOWN}
        {35 SPACES}"
MM 1580 PRINT"{HOME}{12 DOWN}"
        TAB(10);
QA 1590 INPUT B1:IF B1=E THEN1
        330
XM 1600 PRINT"{HOME}{12 DOWN}"
        TAB(9)"{2 SPACES}"B1"
        {LEFT}{3 SPACES}"
DB 1610 IF B1<>B THEN PRINT"
        {DOWN}INCORRECT...":GO
        TO1580
KQ 1620 GOSUB1720
JH 1630 RETURN
AK 1640 PRINT"{CLR}{2 DOWN}
        {5 SPACES}THIS SET OF
        {SPACE}PROBLEMS TOOK Y
        OU
RS 1650 PRINT"{DOWN}{2 SPACES}
        "LEFT$(TI$,2)" HOURS,
        {SPACE}";
CR 1660 PRINTMID$(TI$,3,2)" MI
        NUTES AND "RIGHT$(TI$,
        2)" SECONDS!
KQ 1670 IF TI$<"002000" THEN P
        RINT"{DOWN}{15 SPACES}
        {RVS}GOOD JOB!{OFF}":G
        OTO1690
DA 1680 PRINT"{DOWN} IT TAKES
        {SPACE}PRACTICE"
FJ 1690 PRINT"{DOWN}{4 SPACES}
        MORE PROBLEMS (Y/N)";:
        INPUT Q$
BB 1700 IF LEFT$(Q$,1)<>"Y"THE
        N PRINT"{CLR}":END
ME 1710 GOTO50
RA 1720 PRINT"{DOWN}PRESS ANY
        {SPACE}KEY...
ED 1730 GET AA$:IF AA$="" THEN
        1730
HX 1740 RETURN
EA 1750 PRINT"{CLR}{DOWN}THIS
        {SPACE}IS PROBLEM #";P
        ;"{LEFT}."
XE 1760 PRINT"{DOWN} "XTAB(11)
        A
HM 1770 PRINT" CCC{3 SPACES}*
        {3 SPACES}CCC ="
DB 1780 PRINT" "YTAB(11)B:RETU
        RN
GE 1790 PRINTTAB(N);:IF L=1 TH
        EN PRINT"{2 UP} N{H}
        {DOWN}{5 LEFT}
        {4 SPACES}{H}{DOWN}
        {3 LEFT} {P}L{UP}"
PC 1800 IF L=2 THEN PRINT"
        {2 UP}N{Y}M{DOWN}
        {5 LEFT}{2 SPACES}
        {2 P}N{DOWN}{3 LEFT}L
        {2 P}{UP}"
PH 1810 IF L=3 THEN PRINT"
        {2 UP}{2 Y}M{DOWN}
        {5 LEFT}{3 SPACES}C<
        {DOWN}{3 LEFT}{2 P}N
        {UP}"
KC 1820 IF L=4 THEN PRINT"
        {2 UP}{H} {H}{DOWN}
        {5 LEFT}{2 SPACES}L{P}
        L{DOWN}{LEFT}{H}{UP}"
MQ 1830 IF L=5 THEN PRINT"
        {2 UP}O{2 Y}{DOWN}
        {5 LEFT}{2 SPACES}
        {2 Y}M{DOWN}{3 LEFT}M
        {P}N{UP}"
XM 1840 IF L=6 THEN PRINT"
        {2 UP}N{2 Y}{DOWN}
        {5 LEFT}{2 SPACES}O{Y}
        M{DOWN}{3 LEFT}M{P}N
        {UP}"
CG 1850 IF L=7 THEN PRINT"
        {2 UP}O{Y}P{DOWN}
        {5 LEFT}{4 SPACES}N
        {DOWN}{LEFT}{H}{UP}"
CH 1860 IF L=8 THEN PRINT"
        {2 UP}N{Y}M{DOWN}
        {5 LEFT}{2 SPACES}>C<
        {DOWN}{3 LEFT}M{P}N
        {UP}"
RG 1870 IF L=9 THEN PRINT"
        {2 UP}N{Y}M{DOWN}
        {5 LEFT}{2 SPACES}M{P}
        @{DOWN}{3 LEFT} {P}N
        {UP}"
FC 1880 IF L=0 THEN PRINT"
        {2 UP}N{Y}M{DOWN}
        {3 LEFT}{H} {N}{DOWN}
        {3 LEFT}M{P}N{DOWN}
        {LEFT}{2 UP}"
XK 1890 RETURN
```

Litterbug

Article on page 44.

Program 1: Litterbug—Boot Program

```
KC 10 REM COPYRIGHT 1987 COMPU
      TE! PUBLICATIONS, INC. -
       ALL RIGHTS RESERVED
ER 20 IFA>0THEN50
XB 30 POKE53280,6:POKE53281,6:
      PRINT"{CLR}{BLK}
      {3 SPACES}COPYRIGHT 1987
       COMPUTE! PUB., INC."
AA 40 PRINTTAB(10)"ALL RIGHTS
      {SPACE}RESERVED"
SG 50 IFA=0THENA=1:PRINT"
      {DOWN}LOADING LB1...":LO
      AD"LB1",8,1
BJ 60 IFA=1THENA=2:PRINT"
      {DOWN}LOADING LB2...":LO
      AD"LB2",8,1
BH 70 IFA=2THENA=3:PRINT"
      {DOWN}LOADING LITTERBUG.
      ..":LOAD"LITTERBUG",8,1
KR 80 SYS49201
```

Program 2: Litterbug—Machine Language

See instructions in article on page 44 before typing in.

```
C021:31 12 00 00 00 00 00 00 BF
C029:00 00 00 00 00 00 00 00 AA
C031:A2 00 8E 0B C0 8E 0E C0 A3
C039:8E 10 D0 8E 03 C0 8E 27 68
C041:D0 8E 13 C0 8E 14 C0 8E 12
C049:16 C0 8E 1C C0 8E 1F C0 D8
C051:E8 8E 15 C0 8E 17 C0 E8 D4
C059:8E 0C C0 E8 8E 28 D0 8E 11
C061:29 D0 E8 8E 0F C0 E8 8E 8D
C069:25 D0 8E 1D C0 8E 2B D0 BC
C071:E8 E8 8E 26 D0 A9 0D 8D AA
C079:2A D0 A9 27 8D F8 07 8D D7
C081:0A C0 A9 3A 8D FB 07 8D 09
C089:FD 07 A9 2F 8D 1E C0 A9 04
C091:17 8D 1C D0 A2 18 BD AF 33
C099:CE 9D 00 D4 CA 10 F7 A9 67
C0A1:AD 8D 00 D0 A9 64 8D 01 65
C0A9:D0 A9 9E 8D 03 D0 8D 05 26
C0B1:D0 A9 7B 8D 02 D0 A9 DE D3
C0B9:8D 04 D0 20 68 CC 78 A9 30
C0C1:D9 8D 14 03 A9 CB 8D 15 F2
C0C9:03 58 A9 07 8D 15 D0 20 0B
C0D1:CE C5 20 50 C6 A2 06 A9 AB
C0D9:00 9D 23 C0 CA 10 FA A2 62
C0E1:09 DE 3F DA CA 10 FA 20 E1
C0E9:43 CA AD 09 C0 D0 33 A5 5B
C0F1:C5 C9 40 F0 EA C9 04 D0 37
C0F9:E6 AD 21 C0 C9 39 90 0A E8
C101:A9 30 8D 21 C0 A9 14 8D 8B
C109:22 C0 EE 21 C0 CE 22 C0 04
C111:CE 22 C0 AD 21 C0 8D E7 86
C119:07 A5 C5 C9 40 D0 FA 4C 66
C121:E0 C0 A9 00 8D 15 D0 20 FC
C129:30 C5 A9 F0 A2 FA CA 9D AE
C131:00 04 9D FA 04 9D F4 05 9E
C139:9D EE 06 D0 F1 20 3F C9 6D
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C141:A9 16 8D 20 C0 20 AB CC 7D
C149:A9 00 8D 20 D0 AD 18 D0 93
C151:29 F0 09 08 8D 18 D0 AD 63
C159:11 D0 09 20 8D 11 D0 A9 B8
C161:07 8D 15 D0 20 0B C9 A9 E5
C169:00 8D 0D C0 20 43 CA AD 4F
C171:08 C0 18 6D 07 C0 F0 EF 10
C179:A9 00 85 A1 8D 18 C0 AD 98
C181:8D 02 F0 09 A6 A1 AC 8D 9D
C189:02 D0 FB 86 A1 AD 1B D4 F8
C191:D0 19 AD 10 C0 C9 07 B0 66
C199:12 EE 1F C0 AD 1F C0 C9 07
C1A1:06 D0 08 A9 00 8D 1F C0 2D
C1A9:20 55 C5 A5 A1 C9 60 B0 4B
C1B1:0B CD 18 C0 F0 06 8D 18 10
C1B9:C0 20 70 CA AD 0D C0 10 93
C1C1:0B A9 00 8D 0D C0 20 83 3D
C1C9:C5 4C CF C1 D0 0B AD 1C 83
C1D1:C0 F0 03 4C C9 C2 4C CC D5
C1D9:C3 A9 00 8D 0A D0 8D 0B 3C
C1E1:D0 A9 DF 2D 15 D0 8D 15 23
C1E9:D0 A9 F0 8D 06 D4 A9 9B A9
C1F1:85 FB A9 CD 85 FC A9 01 BD
C1F9:8D 0E C0 A9 00 8D 0B C0 87
C201:A9 41 8D 04 D4 A9 33 8D DE
C209:F8 07 A9 C8 8D 00 C0 20 9C
C211:F5 C5 EE F8 07 AD F8 07 58
C219:C9 3A D0 EE A9 39 8D F8 61
C221:07 AD 15 D0 29 FE 8D 15 BA
C229:D0 AE 0F C0 A0 07 E0 01 94
C231:D0 03 4C B3 CA CA CA 8A 46
C239:0A 0A 0A AA A9 00 9D 90 4B
C241:37 E8 88 10 F9 CE 0F C0 98
C249:20 30 C5 A0 00 B1 FB D0 3D
C251:FA A9 01 0D 15 D0 8D 15 CB
C259:D0 A9 C8 8D 00 C0 20 F5 DC
C261:C5 CE F8 07 AD F8 07 C9 36
C269:32 D0 EE A9 27 8D F8 07 1D
C271:A9 40 8D 04 D4 20 F5 C5 A6
C279:A9 29 8D F8 07 8D 0A C0 A2
C281:A9 00 8D 0E C0 8D 0B C0 81
C289:A0 0F A9 10 8D 01 D4 A9 1D
C291:41 8D 04 D4 AD 1B D4 8D F9
C299:03 D4 8D 00 D4 A9 B4 8D CB
C2A1:00 C0 20 F5 C5 88 D0 EC 99
C2A9:A9 27 8D F8 07 8D 0A C0 52
C2B1:A9 40 8D 04 D4 A9 0E 8D 05
C2B9:03 D4 20 0F CA 20 27 CA DA
C2C1:A9 2F 8D 1E C0 4C 68 C1 45
C2C9:C9 02 F0 6F AD 00 D0 8D 66
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C2D9:A9 08 0D 15 D0 8D 15 D0 E0
C2E1:A9 02 8D 1C C0 A9 1E 8D A6
C2E9:08 D4 CE 1D C0 CE 10 C0 76
C2F1:AD 10 C0 0A 0A 0A AA A9 82
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C309:A9 21 8D 0B D4 A9 96 8D 18
C311:00 C0 20 F5 C5 A9 20 8D CE
C319:0B D4 AD 20 C0 C9 16 F0 5D
C321:05 A9 16 4C 29 C3 A9 14 DC
C329:8D 20 C0 20 AB CC A9 64 E1
C331:8D 00 C0 20 F5 C5 CE 05 03
C339:C0 D0 CD CE 0C C0 30 03 C2
C341:4C 61 C4 A9 04 8D 0C C0 A9
C349:AD 06 D0 CD 04 D0 F0 0B 70
C351:90 06 EE 04 D0 4C 5C C3 F4
C359:CE 04 D0 AD 07 D0 CD 05 5A
C361:D0 90 06 EE 05 D0 4C 84 AD
C369:C3 CE 05 D0 4C 84 C3 AD DD
C371:06 D0 CD 02 D0 90 06 EE CD
C379:02 D0 4C 9A C3 CE 02 D0 97
C381:4C 9A C3 AD 07 D0 CD 03 43
C389:D0 F0 E4 90 06 EE 03 D0 1E
C391:4C 70 C3 CE 03 D0 4C 70 25
C399:C3 AD 1E D0 C9 0E F0 0B B2
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C3A9:4C 27 C4 A9 00 8D 1C C0 83
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C3B9:A9 F7 2D 15 D0 8D 15 D0 C2
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C3F1:D0 90 06 EE 05 D0 4C 14 CD
C3F9:C4 CE 05 D0 4C 14 C4 AD 2F
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C411:4C 27 C4 AD 01 D0 CD 03 E7
C419:D0 F0 E4 90 06 EE 03 D0 AF
C421:4C 27 C4 CE 03 D0 AD 15 EB
C429:C0 C9 02 90 33 AD 00 D0 EF
C431:CD 08 D0 F0 1A 90 12 EE F2
C439:08 D0 AD 15 C0 C9 03 90 C5
C441:1F AD 1C C0 F0 1A 4C 50 2E
C449:C4 CE 08 D0 4C 3B C4 AD 7D
C451:01 D0 CD 09 D0 90 06 EE 9D
C459:09 D0 4C 61 C4 CE 09 D0 7F
C461:20 B1 C6 AD 22 C0 8D 00 4A
C469:C0 20 F5 C5 A9 10 8D 0B 2A
C471:D4 20 43 CA AD 07 C0 D0 5E
C479:74 AD 08 C0 D0 2D AD 09 55
C481:C0 D0 16 AD F8 07 C9 27 DB
C489:F0 0C C9 28 F0 08 A9 27 6C
C491:8D 0A C0 8D F8 07 4C 80 52
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C4A9:4C 80 C1 10 20 AD F8 07 63
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C4C9:00 D0 4C 80 C1 AD F8 07 D6
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C4F1:F8 07 C9 2B F0 0C C9 2C 1D
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C511:F8 07 C9 29 F0 0C C9 2A 1C
C519:F0 08 A9 29 8D 0A C0 8D 8A
C521:F8 07 AD 01 D0 C9 ED B0 EA
C529:C1 EE 01 D0 4C 80 C1 A9 10
C531:8B 8D 00 D0 A9 8E 8D 01 96
C539:D0 8D 09 D0 A9 8B 8D 02 57
C541:D0 8D 04 D0 A9 E9 8D 03 39
C549:D0 A9 36 8D 05 D0 A9 1B 21
C551:8D 08 D0 60 A9 AA 8D 01 D9
C559:D4 A9 FC 8D 06 D4 AD 1B 2C
C561:D4 C9 37 90 F9 C9 EF B0 41
C569:F5 8D 0A D0 8D 0B D0 A9 85
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C579:D0 8D 15 D0 A9 14 8D 04 3D
C581:D4 60 A9 32 8D 01 D4 A9 AB
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C5B9:C0 AD 10 C0 A0 07 0A 0A 5E
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C5D9:91 FB C8 D0 FB E6 FC E4 AD
C5E1:FC B0 F5 60 A9 1B 8D 11 C2
C5E9:D0 A9 15 8D 18 D0 A9 97 B2
C5F1:8D 00 DD 60 A9 1E 8D 01 E7
C5F9:C0 CE 01 C0 D0 FB CE 00 D9
C601:C0 D0 F1 60 A9 00 85 FC BC
C609:AD 02 C0 29 F8 8D 05 C0 61
C611:A9 07 2D 04 C0 0D 05 C0 20
C619:A8 AD 04 C0 29 F8 A2 02 67
C621:0A 26 FC CA 10 FA 85 FB FC
C629:AD 04 C0 4A 4A 4A 18 6D 64
C631:03 C0 69 20 65 FC 85 FC C6
C639:60 20 05 C6 A9 07 2D 02 D1
C641:C0 AA E8 38 A9 00 6A CA 67
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C661:C9 F0 D0 F3 A9 F0 8D 02 97
C669:C0 20 3A C6 A9 00 8D 02 7D
C671:C0 20 3A C6 EE 04 C0 AD D1
C679:04 C0 C9 C8 90 E6 CE 04 C0
C681:C0 20 3A C6 EE 02 C0 AD D9
C689:02 C0 C9 F0 D0 F3 A9 08 42
C691:8D 04 C0 A9 08 8D 02 C0 D4
C699:20 3A C6 AD 02 C0 18 69 26
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C6A9:18 69 08 C9 C8 90 E1 60 E7
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C6B9:AD 00 D0 38 E9 15 8D 02 7C
C6C1:C0 AD 01 D0 38 E9 31 8D A1
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C6D9:05 C0 D0 2F EE 11 C0 AD 12
C6E1:11 C0 C9 07 F0 06 EE 02 51
C6E9:C0 4C CB C6 A9 00 8D 11 4A
C6F1:C0 EE 12 C0 AD 12 C0 C9 EA
C6F9:07 F0 0F EE 04 C0 AD 02 98
C701:C0 38 E9 06 8D 02 C0 4C DE
C709:CB C6 60 A9 11 8D 0B D4 80
C711:20 18 C7 20 65 C7 60 AE 6B
C719:1D C0 A9 0A FE 23 C0 DD 21
C721:23 C0 F0 03 4C 38 C7 A9 3D
C729:00 9D 23 C0 CA FE 23 C0 E9
C731:BD 23 C0 C9 0A F0 F0 A2 B5
C739:05 BD 23 C0 0A 0A 0A A8 60
C741:18 69 08 8D 05 C0 8A 0A 5B
C749:0A 0A AA B9 0B CD 9D C8 E4
C751:2E E8 C8 CC 05 C0 D0 F3 D8
C759:8A 38 E9 08 4A 4A 4A AA B4
C761:CA 10 D6 60 EE 13 C0 AD 2E
C769:13 C0 C9 74 F0 01 60 A9 29
C771:00 8D 13 C0 EE 14 C0 AD C9
C779:14 C0 C9 06 D0 F0 A9 27 A1
C781:8D F8 07 8D 0A C0 A9 00 76
C789:8D 0B D4 68 68 68 68 A9 23
C791:F0 8D 06 D4 A9 00 8D 19 8C
C799:C0 AD 15 C0 C9 05 90 05 2C
C7A1:A9 04 4C A8 C7 A9 05 8D 97
C7A9:1D C0 AD 1E C0 D0 03 4C 2B
C7B1:33 C8 8D 18 C0 EE 18 C0 F2
C7B9:AD 18 C0 8D 1A C0 AD 19 5F
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C7C9:19 C0 0E 18 C0 2E 19 C0 0B
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C7D9:C0 AD 1B C0 6D 19 C0 8D 83
C7E1:19 C0 0E 18 C0 2E 19 C0 23
C7E9:A9 B4 8D 01 D4 EE 18 C0 90
C7F1:D0 03 EE 19 C0 A9 15 8D 7E
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C809:C0 20 F5 C5 A9 14 8D 04 DA
C811:D4 AD 27 C0 8D 06 C0 20 8F
C819:18 C7 AD 27 C0 CD 06 C0 DA
C821:F0 D3 20 70 CA AD 27 C0 47
C829:0A 0A 0A 8D 01 D4 4C 8A
C831:F6 C7 A9 01 8D 01 D4 A9 39
C839:14 8D 04 D4 EE 15 C0 AD 01
C841:15 C0 C9 02 D0 0B AD 15 0A
C849:D0 09 10 8D 15 D0 4C 7C 61
C851:C8 C9 03 D0 08 A9 03 8D A1
C859:45 C3 4C 7C C8 C9 04 D0 16
C861:08 A9 02 8D 45 C3 4C 7C C8
C869:C8 C9 05 D0 0E CE 1D C0 26
C871:20 F3 C8 A9 01 8D 45 C3 50
C879:4C 7C C8 A9 0A A2 01 FE DF
C881:16 C0 DD 16 C0 F0 03 4C 87
C889:94 C8 A9 00 9D 16 C0 CA 5E
C891:FE 16 C0 A2 01 BD 16 C0 56
C899:0A 0A 0A A8 18 69 08 8D 82
C8A1:05 C0 8A 0A 0A 0A AA B9 5F
C8A9:0B CD 9D F0 33 E8 C8 CC 92
C8B1:05 C0 D0 F3 8A 38 E9 08 60
C8B9:4A 4A 4A AA CA 10 D6 A9 E4
C8C1:00 8D 13 C0 8D 14 C0 20 83
C8C9:30 C5 20 50 C6 A9 2F 8D B6
C8D1:1E C0 A9 F7 2D 15 D0 8D 44
C8D9:15 D0 A9 00 8D 1C C0 A9 67
C8E1:16 8D 20 C0 20 AB CC A9 E4
C8E9:14 8D 08 D4 20 0F CA 4C 56
C8F1:65 C1 AD 0F C0 0A 0A 0A 99
C8F9:A8 88 A2 07 BD 8B CD 99 18
C901:90 37 88 CA 10 F6 EE 0F B1
C909:C0 60 A9 F0 8D 06 D4 A9 31
C911:15 8D 04 D4 A9 00 8D 05 CD
C919:C0 A8 98 AA AD 05 C0 18 10
C921:69 01 8D 05 C0 8D 01 D4 BE
C929:F0 06 CA D0 FD 4C 1B C9 3E
C931:C8 C8 C8 C8 C0 AC D0 E2 3E
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C939:A9 14 8D 04 D4 60 A0 37 39
C941:B9 D3 CC 99 C8 24 98 48 2A
C949:4A 4A 4A A8 A9 30 99 99 43
C951:04 99 89 05 99 78 06 68 F1
C959:A8 88 10 E4 A0 37 A2 07 E1
C961:BD 0B CD 99 C8 2E CA 10 8E
C969:02 A2 07 88 10 F2 20 AC 49
C971:CB A2 10 BD D3 CC 9D 40 BE
C979:2C E8 E0 38 D0 F5 A2 00 A0
C981:BD 5B CD 9D C0 33 E8 E0 E3
C989:30 D0 F5 A2 0F BD 0B CD A5
C991:9D F0 33 CA 10 F7 A9 F0 E7
C999:8D 7E 06 A2 00 A0 00 BD BE
C9A1:8B CD 99 90 37 E8 E0 08 D1
C9A9:D0 02 A2 00 C8 C0 18 D0 C4
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C9C1:A9 70 9D F2 06 CA 10 FA 9F
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C9E1:3A C6 EE 02 C0 AD 02 C0 C3
C9E9:C9 39 D0 E6 CE 04 C0 A9 EA
C9F1:07 8D 02 C0 20 3A C6 A9 D9
C9F9:38 8D 02 C0 20 3A C6 CE 9F
CA01:04 C0 AD 04 C0 C9 AF D0 1C
CA09:E6 A9 00 8D 03 C0 A2 2F E4
CA11:BD E0 CD 49 FF 9D 88 3C CF
CA19:CA 10 F5 A2 05 A9 56 9D 1A
CA21:91 07 CA 10 FA 60 A2 00 3A
CA29:A0 00 BD 93 CD 99 00 3A 0F
CA31:E8 E0 08 D0 02 A2 00 C8 E4
CA39:C0 40 D0 EE A9 08 8D 10 E0
CA41:C0 60 A9 00 8D 09 C0 8D 24
CA49:08 C0 8D 07 C0 AD 00 DC CE
CA51:4A B0 03 CE 07 C0 4A B0 06
CA59:03 EE 07 C0 4A B0 03 CE 03
CA61:08 C0 4A B0 03 EE 08 C0 24
CA69:4A B0 03 EE 09 C0 60 AD 59
CA71:1E C0 F0 25 18 69 08 8D BA
CA79:02 C0 A9 B0 8D 04 C0 A9 28
CA81:01 8D 03 C0 20 9B CA EE 5B
CA89:04 C0 AD 04 C0 C9 B8 D0 B6
CA91:F3 CE 1E C0 A9 00 8D 03 10
CA99:C0 60 20 05 C6 A9 07 2D 14
CAA1:02 C0 AA E8 38 A9 00 6A 1F
CAA9:CA D0 FC 49 FF 31 FB 91 5B
CAB1:FB 60 A9 EA A2 02 9D DB 75
CAB9:CB CA 10 FA A9 F0 8D 06 CB
CAC1:D4 A9 14 8D 0F D4 A0 00 94
CAC9:B1 FB D0 FA CE 00 C0 20 19
CAD1:F5 C5 CE 00 C0 20 F5 C5 E5
CAD9:A9 40 8D 04 D4 A9 00 8D 21
CAE1:15 D0 8D 1C D0 A9 0D 8D 7E
CAE9:F8 07 A9 0E 8D F9 07 A9 DF
CAF1:0F 8D FA 07 A9 3B 8D FB 93
CAF9:07 8D FE 07 A9 3C 8D FC 1D
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CB09:8D FF 07 A2 0E A9 00 9D 27
CB11:01 D0 BD D0 CD 9D 00 D0 D7
CB19:CA CA 10 F1 A2 07 A9 01 6F
CB21:9D 27 D0 CA 10 FA A9 FF D7
CB29:8D 00 C0 20 F5 C5 A9 FF BB
CB31:8D 15 D0 A9 15 8D 04 D4 45
CB39:A2 00 A9 06 8D 00 C0 20 C5
CB41:F5 C5 FE 01 D0 BD 01 D0 85
CB49:8D 01 D4 C9 8E D0 EB E8 97
CB51:E8 E0 10 D0 E5 A9 14 8D 30
CB59:04 D4 A2 00 BD 23 C0 DD 56
CB61:2A C0 90 0D F0 06 20 9C 9D
CB69:CB 4C 72 CB E8 E0 06 D0 AC
CB71:EB A2 28 CE 00 C0 20 F5 D2
CB79:C5 CA 10 F7 A9 00 8D 15 A5
CB81:D0 20 E5 C5 A9 EE 8D DB A2
CB89:CB A9 2C 8D DC CB A9 D0 0A
CB91:8D DD CB A9 04 8D 45 C3 20
CB99:4C 31 C0 A2 00 BD 23 C0 E3
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CBA9:4C 9E CB A2 06 BD 2A C0 EE
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CBB9:05 C0 8A 0A 0A 0A AA B9 7D
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CBC9:05 C0 D0 F3 8A 38 E9 08 7E
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CBD9:48 08 EE 2C D0 AD 0E C0 52
CBE1:D0 58 AD 1E D0 48 C9 21 EB
CBE9:F0 04 C9 27 D0 05 A9 FF 94
CBF1:8D 0D C0 68 29 29 C9 01 B4
CBF9:D0 05 A9 01 8D 0D C0 EE 91
CC01:0B C0 AD 0B C0 C9 0A D0 C8
CC09:2C A9 00 8D 0B C0 AD 0A BC
CC11:C0 CD F8 07 F0 11 8D F8 ED
CC19:07 A9 31 8D F9 07 8D FA A1
CC21:07 8D FC 07 4C 36 CC EE 75
CC29:F8 07 A9 32 8D F9 07 8D 49
CC31:FA 07 8D FC 07 28 68 4C 81
CC39:31 EA EE 0B C0 AD 0B C0 48
CC41:C9 05 D0 F1 A9 00 8D 0B AD
CC49:C0 A8 B1 FB F0 E7 8D 01 A6
CC51:D4 C8 B1 FB 8D 00 D4 18 AB
CC59:A5 FB 69 02 85 FB A5 FC 76
CC61:69 00 85 FC 4C 36 CC A9 AE
CC69:0E 8D 21 D0 8D 20 D0 A2 CF
CC71:00 BD 10 CE F0 07 20 D2 20
CC79:FF E8 4C 72 CC A2 06 BD B8
CC81:23 C0 18 69 30 9D 07 04 80
CC89:A9 01 9D 07 D8 BD 2A C0 2F
CC91:18 69 30 9D 21 04 A9 01 DE
CC99:9D 21 D8 CA 10 E1 AD 21 96
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CCA9:DB 60 A9 00 85 FD A9 04 F9
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CCB9:C0 91 FD 88 10 FB CA 10 76
CCC1:01 60 A5 FD 18 69 28 85 C4
CCC9:FD A5 FE 69 00 85 FE 4C A2
CCD1:B5 CC 66 66 66 7E 66 66 0D
CCD9:66 FF 3C 3C 18 18 18 3C 7F
CCE1:3C FF 3E 66 60 3C 06 66 2E
CCE9:7C FF 3E 66 60 60 60 66 9B
CCF1:3E FF 7E 66 66 66 66 66 E0
CCF9:7E FF 7E 66 66 7C 7C 6E 95
CD01:66 FF 7E 66 60 7C 60 66 22
CD09:7E FF 3C 7E 66 66 66 7E 6B
CD11:3C 00 18 38 38 18 18 7E 22
CD19:7E 00 3C 7E 0E 1C 38 7E 33
CD21:7E 00 3C 7E 0E 1C 0E 7E E6
CD29:3C 00 0E 1E 36 7F 7F 06 3B
CD31:06 00 7E 7E 60 7E 06 7E 0F
CD39:7E 00 3C 7E 60 7C 66 7E C3
CD41:3C 00 7E 7E 0C 18 18 18 BB
CD49:18 00 3C 7E 66 3C 66 7E CF
CD51:3C 00 3C 7E 66 3E 06 7E 31
CD59:3C 00 60 60 60 60 60 7E E8
CD61:7E FF 7E 66 60 78 60 66 7E
CD69:7E FF 66 66 66 66 66 3C 4D
CD71:18 FF 7E 66 60 78 60 66 5B
CD79:7E FF 60 60 60 60 60 7E 2A
CD81:7E FF 00 60 60 00 60 60 86
CD89:00 00 10 38 10 7C 7C 38 4E
CD91:28 28 10 3C 50 38 14 78 15
CD99:10 00 10 C3 0E 18 0F D2 3D
CDA1:0C 8F 0E 18 0B 30 0C 8F 2B
CDA9:0A 8F 0B 30 09 68 0A 8F 20
CDB1:08 61 09 68 07 E9 08 61 A2
CDB9:07 0C 07 E9 06 47 07 0C C2
CDC1:05 98 06 47 05 47 05 98 23
CDC9:04 B4 05 47 04 30 00 36 C0
CDD1:36 4A 4A 5E 5E 72 72 9A 86
CDD9:9A AE AE C2 C2 D6 D6 00 8F
CDE1:0F 0C 0F 0F 0C 0F 00 00 77
CDE9:C7 EF CC CC EF C7 00 00 6A
CDF1:CC EE 6F 6D EC CC 00 00 0F
CDF9:6C 6C 6C EC EF 6F 00 00 80
CE01:67 6C 67 67 E8 E7 00 00 B7
CE09:C0 20 C0 E0 60 C0 00 93 CE
CE11:97 53 43 4F 52 45 3A 20 E8
CE19:20 20 20 20 20 20 20 20 B6
CE21:20 20 20 20 20 20 20 20 BE
CE29:48 49 20 53 43 4F 52 45 B7
CE31:3A 8D 11 11 11 11 11 11 82
CE39:11 11 11 11 11 11 11 1F E4
CE41:1D 1D 1D 1D 1D 1D 1D 1D DE
CE49:1D 1D 1D 1D 1D 1D 1D 4C 16
CE51:49 54 54 45 52 42 55 47 15
CE59:11 11 11 11 11 9F 9D 9D D6
CE61:9D 9D 9D 9D 9D 9D 9D 9D FE
CE69:9D 9D 9D 9D 20 20 20 20 AC
CE71:20 20 20 20 20 20 20 20 0F
CE79:20 20 20 20 20 20 8D 11 E2
CE81:11 11 11 9B 50 52 45 53 71
CE89:53 20 42 55 54 54 4F 4E 57
CE91:20 54 4F 20 53 54 41 52 01
CE99:54 20 20 20 20 20 20 97 C8
CEA1:53 50 45 45 44 20 28 9E 8B
CEA9:46 31 97 29 3A 00 00 00 0E
CEB1:00 0E 00 00 00 00 14 00 FA
CEB9:00 00 00 F0 00 C8 00 00 89
CEC1:80 00 00 00 00 00 8F 00 BE
```

Program 3: Litterbug—Sprite Data 1

See instructions in article on page 44 before typing in.

```
0340:00 7E 00 00 FF 00 00 C3 A9
0348:00 00 C0 00 00 C0 00 00 69
0350:C7 00 00 C7 00 00 C3 00 3E
0358:00 FF 00 00 7E 00 00 00 52
0360:00 00 00 00 00 00 00 00 66
0368:00 00 00 00 00 00 00 00 6E
0370:00 00 00 00 00 00 00 00 76
0378:00 00 00 00 00 00 00 FF 7E
0380:00 7E 00 00 FF 00 00 C3 E9
0388:00 00 C3 00 00 C3 00 00 16
0390:FF 00 00 FF 00 00 C3 00 1E
0398:00 C3 00 00 C3 00 00 00 AD
03A0:00 00 00 00 00 00 00 00 A6
03A8:00 00 00 00 00 00 00 00 AE
03B0:00 00 00 00 00 00 00 00 B6
03B8:00 00 00 00 00 00 00 FF BE
03C0:00 42 00 00 E7 00 00 FF 96
03C8:00 00 DB 00 00 C3 00 00 59
03D0:C3 00 00 C3 00 00 C3 00 7C
03D8:00 C3 00 00 C3 00 00 00 ED
03E0:00 00 00 00 00 00 00 00 E6
03E8:00 00 00 00 00 00 00 00 EE
03F0:00 00 00 00 00 00 00 00 F6
03F8:00 00 00 00 00 00 00 FF FE
```

Program 4: Litterbug—Sprite Data 2

See instructions in article on page 44 before typing in.

```
09C0:03 00 00 0F C0 00 0F C0 2A
09C8:00 02 00 00 0A 80 00 2A D7
09D0:A0 00 2A A0 00 2B D0 00 D0
09D8:0A 54 00 08 54 00 08 80 B8
09E0:00 0C C0 00 00 00 00 00 0E
09E8:00 00 00 00 00 00 00 00 FA
09F0:00 00 00 00 00 00 00 00 03
09F8:00 00 00 00 00 00 00 00 0B
0A00:03 00 00 0F C0 00 0F C0 6B
0A08:00 02 00 00 0A 80 00 2A 19
0A10:A0 00 2A A0 00 1F A0 00 81
0A18:56 80 00 54 80 00 08 80 51
0A20:00 0C C0 00 00 00 00 00 4F
0A28:00 00 00 00 00 00 00 00 3C
0A30:00 00 00 00 00 00 00 00 44
0A38:00 00 00 00 00 00 00 00 4C
0A40:03 00 00 0F C0 00 0F C0 AB
0A48:00 02 00 00 0A 80 00 2A 59
0A50:A0 00 AA A0 00 AF D0 00 74
0A58:0A 54 00 08 54 00 0C 80 42
0A60:00 00 C0 00 00 00 00 00 8C
0A68:00 00 00 00 00 00 00 00 7C
0A70:00 00 00 00 00 00 00 00 84
0A78:00 00 00 00 00 00 00 00 8C
0A80:03 00 00 0F C0 00 0F C0 EB
0A88:00 02 00 00 0A 80 00 2A 99
0A90:A0 00 2A 90 00 0A 54 00 14
0A98:0A 54 00 08 80 00 08 C0 1C
0AA0:00 0C 00 00 00 00 00 00 B7
0AA8:00 00 00 00 00 00 00 00 BC
0AB0:00 00 00 00 00 00 00 00 C4
0AB8:00 00 00 00 00 00 00 00 CC
0AC0:03 00 00 0F C0 00 0F C0 2C
0AC8:00 02 00 00 0A 80 00 2A D9
0AD0:A0 00 2A A8 00 1F E8 00 53
0AD8:5A 80 00 58 80 00 08 C0 94
0AE0:00 0C 00 00 00 00 00 00 F7
0AE8:00 00 00 00 00 00 00 00 FC
```

```
ØAF0:00 00 00 00 00 00 00 00 05
ØAF8:00 00 00 00 00 00 00 00 ØD
ØB00:03 00 00 0F C0 00 0F C0 6D
ØB08:00 02 00 00 0A 80 00 2A 1B
ØB10:A0 00 1A A0 00 5F C0 00 C2
ØB18:5A 80 00 08 80 00 0C 80 98
ØB20:00 00 C0 00 00 00 00 00 4E
ØB28:00 00 00 00 00 00 00 00 3E
ØB30:00 00 00 00 00 00 00 00 46
ØB38:00 00 00 00 00 00 00 00 4E
ØB40:03 00 00 0F C0 00 0F C0 AD
ØB48:00 02 00 00 8A 80 00 AA DF
ØB50:80 00 2A 80 00 1F C0 00 F1
ØB58:56 80 00 54 80 00 08 80 93
ØB60:00 3B 80 00 00 00 00 00 55
ØB68:00 00 00 00 00 00 00 00 7E
ØB70:00 00 00 00 00 00 00 00 86
ØB78:00 00 00 00 00 00 00 00 8E
ØB80:03 00 00 0F C0 00 0F C0 ED
ØB88:00 02 00 00 0A 80 00 AA 1C
ØB90:80 00 9A 80 00 57 C0 00 21
ØB98:56 80 00 08 80 00 02 80 Ø3
ØBA0:00 0F 80 00 00 00 00 00 8A
ØBA8:00 00 00 00 00 00 00 00 BE
ØBB0:00 00 00 00 00 00 00 00 C6
ØBB8:00 00 00 00 00 00 00 00 CE
ØBC0:30 00 00 FC 00 00 FC 00 B8
ØBC8:00 20 00 00 A8 80 00 AA D8
ØBD0:80 00 AA 00 00 FD 00 00 74
ØBD8:A5 40 00 85 40 00 88 00 3D
ØBE0:00 BB 00 00 00 00 00 00 E5
ØBE8:00 00 00 00 00 00 00 00 FE
ØBF0:00 00 00 00 00 00 00 00 07
ØBF8:00 00 00 00 00 00 00 00 0F
ØC00:30 00 00 FC 00 00 FC 00 F9
ØC08:00 20 00 00 A8 00 00 AA 18
ØC10:80 00 A9 80 00 F5 40 00 FD
ØC18:A5 40 00 88 00 00 A0 00 DC
ØC20:00 BC 00 00 00 00 00 00 67
ØC28:00 00 00 00 00 00 00 00 40
ØC30:00 00 00 00 00 00 00 00 48
ØC38:00 00 00 00 00 00 00 00 50
ØC40:00 00 00 02 00 00 22 20 DC
ØC48:00 08 80 00 8B 88 00 2F 20
ØC50:E0 00 8D C8 00 2F E0 00 95
ØC58:8B 88 00 08 80 00 22 20 41
ØC60:00 02 00 00 00 00 00 00 F8
ØC68:00 00 00 00 00 00 00 00 80
ØC70:00 00 00 00 00 00 00 00 88
ØC78:00 00 00 00 00 00 00 00 90
ØC80:00 00 00 02 00 00 08 80 49
ØC88:00 88 88 00 2B A0 00 0F BE
ØC90:C0 00 AD E8 00 0F C0 00 0B
ØC98:2B A0 00 88 88 00 08 80 CB
ØCA0:00 02 00 00 00 00 00 00 39
ØCA8:00 00 00 00 00 00 00 00 C0
ØCB0:00 00 00 00 00 00 00 00 C8
ØCB8:00 00 00 00 00 00 00 00 D0
ØCC0:00 00 00 03 00 00 0F C0 E7
ØCC8:00 0F C0 00 02 00 00 2A F6
ØCD0:A0 00 2A A0 00 2B D0 00 D6
ØCD8:0A 54 00 08 54 00 08 80 BE
ØCE0:00 0C C0 00 00 00 00 00 14
ØCE8:00 00 00 00 00 00 00 00 01
ØCF0:00 00 00 00 00 00 00 00 09
ØCF8:00 00 00 00 00 00 00 00 11
ØD00:00 00 00 00 00 00 03 00 20
ØD08:00 0F C0 00 0F C0 00 02 7B
ØD10:00 00 2A A0 00 2B D0 00 C7
ØD18:0A 54 00 08 54 00 08 80 FF
ØD20:00 0C C0 00 00 00 00 00 55
ØD28:00 00 00 00 00 00 00 00 42
ØD30:00 00 00 00 00 00 00 00 4A
ØD38:00 00 00 00 00 00 00 00 52
ØD40:00 00 00 00 00 00 00 00 5A
ØD48:00 00 00 00 03 00 00 0F 89
ØD50:C0 00 0F C0 00 02 00 00 C0
ØD58:2A A0 00 2B D0 00 0A 54 51
ØD60:00 0C C0 00 00 00 00 00 95
ØD68:00 00 00 00 00 00 00 00 82
ØD70:00 00 00 00 00 00 00 00 8A
ØD78:00 00 00 00 00 00 00 00 92
ØD80:00 00 00 00 00 00 00 00 9A
ØD88:00 00 00 00 00 00 00 03 A5
ØD90:00 00 0F C0 00 0F C0 00 56
ØD98:2A A0 00 2B D0 00 0A 54 91
ØDA0:00 0C C0 00 00 00 00 00 D5
ØDA8:00 00 00 00 00 00 00 00 C2
ØDB0:00 00 00 00 00 00 00 00 CA
ØDB8:00 00 00 00 00 00 00 00 D2
ØDC0:00 00 00 00 00 00 00 00 DA
ØDC8:00 00 00 00 00 00 00 00 E2
ØDD0:00 00 00 00 00 03 00 00 F6
ØDD8:0F C0 00 2B D0 00 0A 54 4C
ØDE0:00 0C C0 00 00 00 00 00 16
ØDE8:00 00 00 00 00 00 00 00 03
ØDF0:00 00 00 00 00 00 00 00 0B
ØDF8:00 00 00 00 00 00 00 00 13
ØE00:00 00 00 00 00 00 00 00 1C
ØE08:00 00 00 00 00 00 00 00 24
ØE10:00 00 00 00 00 00 00 00 2C
ØE18:03 00 00 0F C0 00 0A 54 15
ØE20:00 0C C0 00 00 00 00 00 57
ØE28:00 00 00 00 00 00 00 00 44
ØE30:00 00 00 00 00 00 00 00 4C
ØE38:00 00 00 00 00 00 00 00 54
ØE40:00 00 00 00 00 00 00 00 5C
ØE48:00 00 00 00 00 00 00 00 64
ØE50:00 00 00 00 00 00 00 00 6C
ØE58:00 00 00 00 00 00 03 C0 3B
ØE60:00 0F 50 00 00 00 00 00 4A
ØE68:00 00 00 00 00 00 00 00 84
ØE70:00 00 00 00 00 00 00 00 8C
ØE78:00 00 00 00 00 00 00 00 94
ØE80:00 00 00 00 C0 00 07 E0 91
ØE88:00 07 B0 00 07 58 00 06 1C
ØE90:B8 00 3D 40 00 76 C0 00 10
ØE98:39 C0 00 1B C0 00 0C 00 51
ØEA0:00 00 00 00 00 00 00 00 BC
ØEA8:00 00 00 00 00 00 00 00 C4
ØEB0:00 00 00 00 00 00 00 00 CC
ØEB8:00 00 00 00 00 00 00 00 D4
ØEC0:00 7F 00 00 FF 00 00 C0 7D
ØEC8:00 00 C0 00 00 FC 00 00 F0
ØED0:FC 00 00 C0 00 00 C0 00 F8
ØED8:00 FF 00 00 7F 00 00 00 F0
ØEE0:00 00 00 00 00 00 00 00 FC
ØEE8:00 00 00 00 00 00 00 00 05
ØEF0:00 00 00 00 00 00 00 00 0D
ØEF8:00 00 00 00 00 00 00 FF 15
ØF00:00 7E 00 00 FF 00 00 C3 81
ØF08:00 00 C3 00 00 C3 00 00 AD
ØF10:C3 00 00 C3 00 00 C3 00 D3
ØF18:00 FF 00 00 7E 00 00 00 2A
ØF20:00 00 00 00 00 00 00 00 3E
ØF28:00 00 00 00 00 00 00 00 46
ØF30:00 00 00 00 00 00 00 00 4E
ØF38:00 00 00 00 00 00 00 FF 56
ØF40:00 C3 00 00 C3 00 00 C3 31
ØF48:00 00 C3 00 00 C3 00 00 ED
ØF50:C3 00 00 66 00 00 66 00 83
ØF58:00 3C 00 00 18 00 00 00 46
ØF60:00 00 00 00 00 00 00 00 7E
ØF68:00 00 00 00 00 00 00 00 86
ØF70:00 00 00 00 00 00 00 00 8E
ØF78:00 00 00 00 00 00 00 FF 96
ØF80:00 7E 00 00 FF 00 00 C3 02
ØF88:00 00 C3 00 00 C3 00 00 2E
ØF90:FE 00 00 FC 00 00 CE 00 9B
ØF98:00 C7 00 00 C3 00 00 00 C6
ØFA0:00 00 00 00 00 00 00 00 BE
ØFA8:00 00 00 00 00 00 00 00 C6
ØFB0:00 00 00 00 00 00 00 00 CE
ØFB8:00 00 00 00 00 00 00 FF D6
```

The Gumball Rally

Article on page 48.

```
KC 10 REM COPYRIGHT 1987 COMPU
      TE! PUBLICATIONS, INC. -
       ALL RIGHTS RESERVED
GH 20 SCALE0:TROFF:PUDEF" ,.$"
CX 30 WINDOW0,0,39,24,1:COLOR0
      ,1:COLOR4,3:POKE247,255:
      POKE248,255
DQ 40 PRINTCHR$(7)CHR$(14)"{83
      {CLR}{3 SPACES}COPYRIGHT
      1987 COMPUTE! PUB., INC
      ."
SM 50 PRINTTAB(10)"ALL RIGHTS
      {SPACE}RESERVED":PRINT"
      {DOWN}JUST A MOMENT..."
HB 60 SLEEP 5:PRINT"{CLR}":FAS
      T:GRAPHIC1,1:GRAPHICCLR
GF 70 DATA00,00,00
SJ 80 DATA00,00,00,00,54,00,01
      ,00,00,54,00,00,FC,00,00
      ,FC
EF 90 DATA00,03,FF,00,03,FF,00
      ,03,FF,00,03,FF,00,03,CF
      ,00
DM 100 DATA03,CF,00,02,AA,00,0
      0,00,00,00,00,00,17,00,
      14,00
JR 110 DATAB9,00,06,EE,40,07,B
      B,40,06,EE,40,07,BB,40,
      01,ED
QE 120 DATA39,00,06,EE,40,07,B
      B,40,06,EE,40,07,BB,40,
      01,ED
AE 130 DATA09,00,06,EE,40,07,B
      B,40,06,EE,40,07,BB,40,
      01,ED
EA 140 DATA01,00,06,EE,40,07,B
      B,40,06,EE,40,07,BB,40,
      01,ED
GB 150 DATA01,00,04,EE,40,07,B
      B,40,06,EE,40,07,BB,40,
      01,ED
RR 160 DATA01,00,04,2E,40,07,B
      B,40,06,EE,40,07,BB,40,
      01,ED
HS 170 DATA01,00,04,0E,40,07,B
      B,40,06,EE,40,07,BB,40,
      01,ED
CM 180 DATA01,00,04,02,40,07,B
      B,40,06,EE,40,07,BB,40,
      01,ED
MF 190 DATA01,00,04,00,40,07,B
      B,40,06,EE,40,07,BB,40,
      01,ED
KA 200 DATA01,00,04,00,40,04,B
      B,40,06,EE,40,07,BB,40,
      01,ED
BJ 210 DATA01,00,04,00,40,04,3
      B,40,06,EE,40,07,BB,40,
      01,ED
HE 220 DATA01,00,04,00,40,04,0
      B,40,06,EE,40,07,BB,40,
      01,ED
MQ 230 DATA01,00,04,00,40,04,0
      3,40,06,EE,40,07,BB,40,
      01,ED
HP 240 DATA01,00,04,00,40,04,0
      0,40,06,EE,40,07,BB,40,
      01,ED
RE 250 DATA01,00,04,00,40,04,0
      0,40,04,EE,40,07,BB,40,
      01,ED
BX 260 DATA01,00,04,00,40,04,0
      0,40,04,2E,40,07,BB,40,
      01,ED
HP 270 DATA01,00,04,00,40,04,0
      0,40,04,0E,40,07,BB,40,
      01,ED
MR 280 DATA01,00,04,00,40,04,0
      0,40,04,02,40,07,BB,40,
      01,ED
GS 290 DATA01,00,04,00,40,04,0
      0,40,04,00,40,07,BB,40,
      01,ED
PB 300 DATA01,00,04,00,40,04,0
      0,40,04,00,40,04,BB,40,
      01,ED
EK 310 DATA01,00,04,00,40,04,0
      0,40,04,00,40,04,3B,40,
      01,ED
QB 320 DATA01,00,04,00,40,04,0
      0,40,04,00,40,04,0B,40,
      01,ED
```

```
JP 330 DATA01,00,04,00,40,04,0
       0,40,04,00,40,04,03,40,
       01,ED
DD 340 DATA01,00,04,00,40,04,0
       0,40,04,00,40,04,00,40,
       01,ED
CF 350 DATA01,00,04,00,40,04,0
       0,40,04,00,40,04,00,40,
       01,2D
BX 360 DATA01,00,04,00,40,04,0
       0,40,04,00,40,04,00,40,
       01,0D
DS 370 DATA01,00,04,00,40,04,0
       0,40,04,00,40,04,00,40,
       01,01
RP 380 DATA00,00,00,00,00,00,0
       0,00,00,00,00,00,00,00,
       00,00
EQ 390 DATA00,00,00,00,00,00,8
       2,00,00,44,00,00,28,00,
       00,10
DF 400 DATA00,00,28,00,00,44,0
       0,00,82,00,00,00,00,00,
       00,00
PH 410 DATA00,00,00,00,00,00,0
       0,00,00,00,00,00,00,00,
       00,17
GS 420 DATA00,14,00
AM 430 REM BUILD SPRITES
GR 440 FORX=1TO10:READA$:S$=S$
       +CHR$(DEC(A$)):NEXT
SD 450 FORX=1TO41:READA$:E$=E$
       +CHR$(DEC(A$)):NEXT:COL
       OR4,4
XD 460 DIMGB$(26),GC(6),CC(6),
       T(2),S(2),C(2),J(2),CS(
       2),CG(2),CV(4),Q(4,2),S
       P(8,2),M1(2),M2(2),TG(2
       )
RQ 470 FORX=1TO6:GC(X)=26:CC(X
       )=0:NEXT:FORX=1TO2:T(X)
       =2.05:S(X)=0:C(X)=0:NEX
       T
AJ 480 FORX1=1TO4:FORX2=1TO2:Q
       (X1,X2)=5:NEXTX2,X1
CG 490 M1(1)=10000:M1(2)=20000
       :M2(1)=2000:M2(2)=12000
FB 500 MC=10:CS(1)=1:CS(2)=1:C
       G(1)=3:CG(2)=4:CV(1)=25
       :CV(2)=10:CV(3)=5:CV(4)
       =1:PLOT=DEC("CC6C"):CM=
       -1:F9=6*MC:NC=-1
RF 510 J7$="":FORX=1TO23:J7$=J
       7$+" ":NEXT
KB 520 RH$=" C G#F G C G#F G$C
        G G G G R R R$C G#F G$
       C G#F G C G G G G R R R
        C G#F G C G#F C$C G G
       {SPACE}G G R R R$C G#F
       {SPACE}G$C G#F G#B G E
       {SPACE}G C R R R"
CJ 530 LH$=" C G E G C G E G D
        G F G D G F G D G F G
       {SPACE}D G F G C G E G
       {SPACE}C G E G":LH$=LH$
       +LEFT$(LH$,58)+" F E D"
QG 540 ENVELOPE3,0,5,0,0,3:TEM
       PO16:PLAY"V2O4IT7RV3O3I
       T5RV1O6IT3R"
AD 550 FORQ1=26TO0STEP-1:W$="":
       :FORQ2=1TO16
SH 560 READA$:W$=W$+CHR$(DEC(A
       $)):NEXT:GB$(Q1)=S$+W$+
       E$:NEXT:COLOR4,7
SK 570 FORX=1TO6:SPRSAVGB$(26)
       ,X:SPRITEX,1,8,0,1,1,1:
       MOVSPRX,40*X+24,90:NEXT
       :SPRCOLOR2,3
CE 580 M$="":FORX=1TO67:READA$
       :M$=M$+CHR$(DEC(A$)):NE
       XT:SPRSAVM$,7:SPRSAVM$,
       8
FS 590 PRINT"{HOME}{6}
       {10 DOWN}{6 RIGHT}{A}*
       {S}{2 SPACES}{A}*{S}
       {2 SPACES}{A}*{S}
       {2 SPACES}{A}*{S}
       {2 SPACES}{A}*{S}
       {2 SPACES}{A}*{S}":PRIN
       T"{6 RIGHT}- -
       {2 SPACES}- -{2 SPACES}
       - -{2 SPACES}- -
       {2 SPACES}- -{2 SPACES}
       - -":PRINT"{6 RIGHT}{Z}
       *{X}{2 SPACES}{Z}*{X}
       {2 SPACES}{Z}*{X}
       {2 SPACES}{Z}*{X}
       {2 SPACES}{Z}*{X}
       {2 SPACES}{Z}*{X}"
BA 600 DATA61,121,101,121,141,
       121,181,121,221,121,261
       ,121,13,145,309,145
PF 610 FORX1=1TO8:FORX2=1TO2:R
       EADSP(X1,X2):NEXTX2,X1
PE 620 PRINT"{HOME}{13 DOWN}
       {A}*{S}{DOWN}{3 LEFT}-
       {SPACE}-{DOWN}{3 LEFT}
       {Z}*{X}{2 UP}";TAB(37);
       "{A}*{S}{3 LEFT}{DOWN}-
       -{3 LEFT}{DOWN}{Z}*{X}
       ":COLOR4,12
QJ 630 PRINT"{HOME}{DOWN}{YEL}
       GUM:{3 SPACES}26
       {3 SPACES}26{3 SPACES}2
       6{3 SPACES}26{3 SPACES}
       26{3 SPACES}26"
GC 640 PRINT"{HOME}{3 DOWN}
       {YEL}COINS:{2 SPACES}0
       {4 SPACES}0{4 SPACES}0
       {4 SPACES}0{4 SPACES}0
       {4 SPACES}0"
CB 650 SYSPLOT,,18,5:PRINT"
       {BLK}PLAYER 1":SYSPLOT,
       ,18,27:PRINT"{8}PLAYER
       {SPACE}2"
DC 660 A$="@Q: 5{5 SPACES}D: 5
       {5 SPACES}N: 5
       {5 SPACES}P: 5
       {5 SPACES}$: 2.05
       {2 SPACES}G: 0
       {4 SPACES}"
MP 670 PRINT"{HOME}{BLK}
       {18 DOWN}";:FORX=0TO5:P
       RINT:PRINT"{5 SPACES}";
       MID$(A$,X*9+1,9);:NEXT
RK 680 PRINT"{HOME}{8}
       {18 DOWN}";:FORX=0TO5:P
       RINT:PRINT"{27 RIGHT}";
       MID$(A$,X*9+1,9);:NEXT
DK 690 COLOR4,15:COLOR0,7
HA 700 PRINT"{HOME}{4 DOWN}":F
       ORX=1TO5:PRINT"
       {5 SPACES}{RVS}{BLK}
       {31 SPACES}":NEXT
CK 710 SYSPLOT,,15,9:PRINT"{3}
       PRESS 'FIRE' TO BEGIN!"
       :COLOR4,3:SLOW
SM 720 SD=SD+1:IFSD=256THENSD=
       0
CK 730 IFJOY(1)>127ORJOY(2)>12
       7THEN770
SR 740 NC=NC+2:IFNC>127THENNC=
       1
CK 750 PLAY"V2O5"+MID$(RH$,NC,
       2):PLAY"V3O2"+MID$(LH$,
       NC,2):SOUND1,30000,1,,,
       3
QD 760 POKE53269,63ANDSD:GOTO7
       20
GH 770 FORK=1TO6:SPRITEK,1,8,0
       ,1,1,1:NEXT
GS 780 SPRITE7,1,1,0,1,1,0:MOV
       SPR7,SP(3,1),SP(3,2):SP
       RITE8,1,16,0,1,1,0:MOVS
       PR8,SP(4,1),SP(4,2)
GE 790 COLOR1,11:CHAR1,9,15,J7
       $
SD 800 SYSPLOT,,14,3:PRINT"
       {YEL}SELL":SYSPLOT,,14,
       31:PRINT"CHANGE"
MK 810 SYSPLOT,,15,3:PRINT"GUM
       BALLS":SYSPLOT,,15,30:P
       RINT"MACHINE"
GF 820 CHAR1,15,15,">>> GO! <<
       <":FORQ=1TO500:NEXT:CHA
       R1,15,15,"{11 SPACES}"
EB 830 SOUND3,30000,32767,1,20
       000,1000,2,025:SOUND2,3
       3300,32767,1,23300,1000
       ,2,025
MQ 840 FORP=1TO2
PM 850 J=JOY(P):IFJ=0THEN890
DJ 860 IFJ>127THEN1080
PF 870 IFJ=1ORJ=5THEN900
AQ 880 IFJ=3ORJ=7THEN950
CE 890 NEXTP:GOTO840
DQ 900 IFP=2THENB=27:PRINT"{8}
       ";:ELSEB=5:PRINT"{BLK}"
       ;
SH 910 C4=CS(P):IFJ=1THENCS(P)
       =CS(P)-1:IFCS(P)<1THENC
       S(P)=4:GOTO930
ER 920 IFJ=5THENCS(P)=CS(P)+1:
       IFCS(P)>4THENCS(P)=1
GX 930 SYSPLOT,,C4+18,B:PRINT"
        ";:SYSPLOT,,CS(P)+18,B
       :PRINT"@";:SOUND1,2000*
       P,1
KM 940 NEXTP:GOTO840
FP 950 IFP=1THENOP=2:ELSEOP=1
AR 960 IFJ=3THEN1030
XF 970 IFCG(P)=1ANDCG(OP)=7THE
       N1020
JR 980 NM=CG(P)-1:IFCG(P)=8THE
       NNM=6
CK 990 IFCG(P)=1ORCG(P)=7THENN
       M=7
KH 1000 IFCG(OP)=NMTHENCG(P)=N
       M:GOTO980
RR 1010 CG(P)=NM:MOVSPR6+P,SP(
       NM,1),SP(NM,2)
DP 1020 SOUND1,1E4*P,1,,,,2,10
       24:NEXTP:GOTO840
EQ 1030 IFCG(P)=6ANDCG(OP)=8TH
       EN1020
GX 1040 NM=CG(P)+1:IFCG(P)=7TH
       ENNM=1
GK 1050 IFCG(P)=6ORCG(P)=8THEN
       NM=8
RQ 1060 IFCG(OP)=NMTHENCG(P)=N
       M:GOTO1040
XA 1070 GOTO1010
GG 1080 IFCG(P)<7THEN1110
SC 1090 IFCG(P)=7THEN1190
EQ 1100 IFCG(P)=8THEN1270
HR 1110 IFQ(CS(P),P)=0ORCC(CG(
       P))>=MCTHENNEXTP:GOTO8
       40
GJ 1120 Z=CG(P):Z1=CS(P):Q(Z1,
       P)=Q(Z1,P)-1:T(P)=T(P)
       -CV(Z1)/100:IFGC(Z)<=C
       V(Z1)THEN1140
FF 1130 GC(Z)=GC(Z)-CV(Z1):S(P
       )=S(P)+CV(Z1):TG(P)=TG
       (P)+CV(Z1):GOTO1150
QQ 1140 S(P)=S(P)+GC(Z):TG(P)=
       TG(P)+GC(Z):GC(Z)=26
RE 1150 CC(Z)=CC(Z)+1:SPRSAVGB
       $(GC(Z)),Z:IFP=1THENPR
       INT"{BLK}";:X=8:ELSE:P
       RINT"{8}";:X=30
XB 1160 SYSPLOT,,18+Z1,X:PRINT
       USING"##";Q(Z1,P):SYSP
       LOT,,23,X:PRINTUSING"#
       #.##{DOWN}{5 LEFT}###"
       ;T(P),S(P):SYSPLOT,,1,
       5*Z+2:PRINTUSING"{YEL}
```

```
        ##{2 DOWN}{2 LEFT}##";
        GC(Z),CC(Z)
PJ 1170 SOUND1,M1(P),3,2,M2(P)
        ,3000,2,1024:IFCC(1)+C
        C(2)+CC(3)+CC(4)+CC(5)
        +CC(6)=F9THEN1340
MQ 1180 NEXTP:GOTO840
AC 1190 IFS(P)=0THENNEXTP:GOTO
        840
CK 1200 PRINTCHR$(7);
PK 1210 Q1=0:D1=0:N1=0:P1=0:K9
        =S(P)
PX 1220 Q1=INT(K9/25):K9=K9-Q1
        *25:D1=INT(K9/10):K9=K
        9-D1*10:N1=INT(K9/5):P
        1=INT(K9-N1*5)
FX 1230 Q(1,P)=Q(1,P)+Q1:Q(2,P
        )=Q(2,P)+D1:Q(3,P)=Q(3
        ,P)+N1:Q(4,P)=Q(4,P)+P
        1:S(P)=0
FF 1240 IFP=1THENPRINT"{BLK}";
        :X=8:ELSE:PRINT"{8}";:
        X=30
QX 1250 T(P)=0:FORJ=1TO4:T(P)=
        T(P)+Q(J,P)*CV(J):SYSP
        LOT,,18+J,X:PRINTUSING
        "##";Q(J,P):NEXT:T(P)=
        T(P)/100
PA 1260 SYSPLOT,,23,X:PRINTUSI
        NG"##.##";T(P):SYSPLOT
        ,,24,X:PRINTUSING"###"
        ;S(P):NEXTP:GOTO840
QX 1270 IFQ(CS(P),P)=0THENNEXT
        P:GOTO840
PA 1280 PRINTCHR$(7);
DP 1290 ONCS(P)GOTO1300,1310,1
        320,1240
GR 1300 Q(1,P)=Q(1,P)-1:Q(2,P)
        =Q(2,P)+2:Q(3,P)=Q(3,P
        )+1:GOTO1240
BH 1310 Q(2,P)=Q(2,P)-1:Q(3,P)
        =Q(3,P)+2:GOTO1240
GP 1320 Q(3,P)=Q(3,P)-1:Q(4,P)
        =Q(4,P)+5:GOTO1240
GJ 1330 REM END OF GAME
DF 1340 FORX=1TO2
EJ 1350 C(X)=S(X):FORJ=1TO4:C(
        X)=C(X)+Q(J,X)*CV(J):N
        EXT:C(X)=C(X)+TG(X):NE
        XT
CC 1360 SYSPLOT,,14,15:PRINT"
        {YEL}GAME OVER"
HB 1370 SYSPLOT,,17,4:PRINT"SC
        ORE:";:PRINTUSING"###
        ";C(1)
CJ 1380 SYSPLOT,,17,26:PRINT"S
        CORE:";:PRINTUSING"###
        #";C(2)
DK 1390 SOUND3,10000,0,0,,,2,2
        048:SOUND2,10000,0,0,,
        ,2,2048
FE 1400 J7=0
SQ 1410 J7=J7+1
JM 1420 SYSPLOT,,14,15:PRINT"
        {YEL}GAME OVER":FORI=1
        TO50:NEXT
SA 1430 SYSPLOT,,16,28:PRINT"
        {YEL}{11 SPACES}";:FOR
        I=1TO50:NEXT
PK 1440 SYSPLOT,,16,10:INPUT"
        {WHT}PLAY AGAIN (Y/N)
        {SPACE}";R$:IFR$="Y"TH
        ENCLR:FORX=1TO8:SPRITE
        X,0:NEXT:RUN
JD 1450 IFR$="N"THENPRINT"
        {CLR}{6}";CHR$(142);:C
        OLOR0,12:COLOR4,14:POK
        E247,0:POKE248,0:POKE5
        3269,0:END
FX 1460 GOTO1430
```

Sprite Monitor

See instructions in article on page 73 before typing in.

Program 1: Sprite Monitor—$5000

```
5000:20 64 50 A9 0C 8D 20 D0 16
5008:A9 0B 8D 21 D0 A9 93 20 78
5010:D2 FF A9 31 85 FC 85 23 B0
5018:A9 C0 85 FB 85 22 A9 30 66
5020:85 3A A9 01 20 AA 50 A9 4D
5028:17 8D 18 D0 A9 FF 8D 15 45
5030:D0 A2 C7 20 B5 50 A9 00 1F
5038:85 39 8D 10 D0 8D 1C D0 62
5040:A5 01 29 FE 85 01 20 4C C5
5048:50 4C CC 50 A9 04 85 09 34
5050:A9 01 85 07 A9 00 85 08 87
5058:A9 11 85 12 A9 04 85 13 5F
5060:20 B2 52 60 A9 55 A0 00 F1
5068:99 00 D0 18 69 30 C8 C8 D7
5070:C0 08 D0 F4 A9 55 A0 00 C0
5078:99 01 D0 C8 C8 C0 08 D0 F6
5080:F7 A9 55 A0 00 99 08 D0 83
5088:18 69 30 C8 C8 C0 08 D0 4C
5090:F4 A9 7F A0 00 99 09 D0 59
5098:C8 C8 C0 08 D0 F7 60 A2 32
50A0:04 A0 B8 88 D0 FD CA D0 EF
50A8:F8 60 A0 00 99 27 D0 C8 C5
50B0:C0 08 D0 F8 60 A0 08 8A 7D
50B8:99 F7 07 CA 8A 88 D0 F8 C2
50C0:60 18 C9 0A B0 03 69 30 06
50C8:60 69 36 60 A0 04 A6 22 45
50D0:8A 29 0F 20 C1 50 91 14 6B
50D8:88 8A 4A 4A 4A 4A 20 C1 CB
50E0:50 91 14 A6 23 88 D0 E8 C0
50E8:A5 CB C9 15 F0 77 A2 5A DE
50F0:20 A1 50 A5 CB C9 23 D0 0B
50F8:03 EE 27 D0 C9 38 D0 03 9C
5100:EE 28 D0 C9 3B D0 03 EE EC
5108:29 D0 C9 08 D0 03 EE 2A C7
5110:D0 C9 0B D0 03 EE 2B D0 F6
5118:C9 10 D0 03 EE 2C D0 C9 81
5120:13 D0 03 EE 2D D0 C9 18 28
5128:D0 03 EE 2E D0 C9 14 D0 5B
5130:03 EE 21 D0 C9 1C D0 03 A4
5138:EE 20 D0 C9 31 F0 20 C9 68
5140:0D F0 19 C9 24 F0 1B C9 4A
5148:2B F0 0E C9 28 F0 07 C9 F7
5150:3C D0 95 4C 65 51 4C 98 5E
5158:52 4C A5 52 4C 9B 51 4C D0
5160:70 52 4C 87 52 A0 00 38 1F
5168:A5 FB E9 C0 85 FB A5 FC 8A
5170:E9 01 85 FC A5 FB 85 22 13
5178:A5 FC 85 23 B1 FB 91 39 E9
5180:C8 D0 F9 A5 3A C9 32 F0 A3
5188:07 E6 FC E6 3A 4C 7C 51 C3
5190:A9 30 85 3A A9 00 85 39 F9
5198:4C CC 50 A0 00 B9 4A 53 77
51A0:F0 0C 99 03 07 A9 01 99 9C
51A8:03 DB C8 4C 9D 51 A5 CB EA
51B0:C9 0A F0 15 C9 16 F0 35 E7
51B8:C9 15 F0 1E C9 0E F0 03 F0
51C0:4C AE 51 20 3F 53 4C E8 2A
51C8:50 20 3F 53 18 A5 23 69 BF
51D0:02 85 11 A5 22 85 10 4C E5
51D8:FB 51 20 3F 53 18 A5 22 2E
51E0:69 40 85 10 A5 23 69 00 86
51E8:85 11 4C FB 51 20 3F 53 B8
51F0:18 A5 23 69 01 85 11 A5 E9
51F8:22 85 10 A9 53 85 12 A9 29
5200:07 85 13 A9 10 85 09 A9 D8
5208:01 85 07 A9 07 85 08 20 88
5210:B2 52 E6 14 A0 00 84 24 F2
5218:84 C6 20 E4 FF C9 00 F0 1B
5220:F9 C9 0D F0 23 C9 14 D0 1E
5228:0F A5 24 F0 ED C6 24 A4 C8
5230:24 A9 20 91 14 4C 1A 52 C6
5238:A4 24 C0 10 F0 DC 91 14 83
5240:99 5E 53 E6 24 4C 1A 52 FA
5248:A9 00 85 9D A9 03 A2 08 F2
5250:A0 FF 20 BA FF A5 24 A2 76
5258:5E A0 53 20 BD FF A6 10 0C
5260:A4 11 A9 22 20 D8 FF 20 77
5268:4C 50 20 3F 53 4C E8 50 2D
5270:AD 1D D0 F0 09 EE 1D D0 6B
5278:EE 17 D0 4C E8 50 CE 1D 7C
5280:D0 CE 17 D0 4C E8 50 AD 85
5288:1C D0 F0 06 EE 1C D0 4C C3
5290:E8 50 CE 1C D0 4C E8 50 33
5298:A9 C0 8D 6B 51 A9 01 8D 6B
52A0:71 51 4C E8 50 A9 40 8D A1
52A8:6B 51 A9 02 8D 71 51 4C CD
52B0:E8 50 18 A5 12 85 16 A5 B3
52B8:13 69 D4 85 17 A0 00 A9 19
52C0:70 91 12 A5 08 91 16 A4 F5
52C8:09 A9 2D 91 12 A5 08 91 E3
52D0:16 88 D0 F5 A9 6E A4 09 75
52D8:C8 91 12 A5 08 91 16 A9 3F
52E0:6D A0 50 91 12 A5 08 91 50
52E8:16 18 A5 12 69 50 85 12 1E
52F0:A5 13 69 00 85 13 18 A5 A8
52F8:16 69 50 85 16 A5 17 69 44
5300:00 85 17 A4 09 A9 2D 91 10
5308:12 A5 08 91 16 88 D0 F5 A5
5310:A9 7D A4 09 C8 91 12 A5 66
5318:08 91 16 38 A5 16 E9 28 EE
5320:85 16 A5 17 E9 00 85 17 A6
5328:A5 07 A4 09 91 16 88 D0 4F
5330:FB 38 A5 12 E9 28 85 14 C7
5338:A5 13 E9 00 85 15 60 A0 95
5340:00 A9 20 99 D0 06 C8 D0 EF
5348:FA 60 C6 49 52 53 54 20 9A
5350:D4 4F 50 20 C1 4C 4C 20 39
5358:C5 58 49 54 3F 00 00 00 60
```

Program 2: Sprite Monitor—$C000

See instructions in article on page 73 before typing in.

```
C000:20 64 C0 A9 0C 8D 20 D0 05
C008:A9 0B 8D 21 D0 A9 93 20 59
C010:D2 FF A9 31 85 FC 85 23 91
C018:A9 C0 85 FB 85 22 A9 30 47
C020:85 3A A9 01 20 AA C0 A9 0F
C028:17 8D 18 D0 A9 FF 8D 15 26
C030:D0 A2 C7 20 B5 C0 A9 00 C1
C038:85 39 8D 10 D0 8D 1C D0 43
C040:A5 01 29 FE 85 01 20 4C A6
C048:C0 4C CC C0 A9 04 85 09 54
C050:A9 01 85 07 A9 00 85 08 68
C058:A9 11 85 12 A9 04 85 13 40
C060:20 B2 C2 60 A9 55 A0 00 E0
C068:99 00 D0 18 69 30 C8 C8 B8
C070:C0 08 D0 F4 A9 55 A0 00 A1
C078:99 01 D0 C8 C8 C0 08 D0 D7
C080:F7 A9 55 A0 00 99 08 D0 64
C088:18 69 30 C8 C8 C0 08 D0 2D
C090:F4 A9 7F A0 00 99 09 D0 3A
C098:C8 C8 C0 08 D0 F7 60 A2 13
C0A0:04 A0 B8 88 D0 FD CA D0 D0
C0A8:F8 60 A0 00 99 27 D0 C8 A6
C0B0:C0 08 D0 F8 60 A0 08 8A 5E
C0B8:99 F7 07 CA 8A 88 D0 F8 A3
C0C0:60 18 C9 0A B0 03 69 30 E6
C0C8:60 69 36 60 A0 04 A6 22 26
C0D0:8A 29 0F 20 C1 C0 91 14 0E
C0D8:88 8A 4A 4A 4A 4A 20 C1 AC
C0E0:C0 91 14 A6 23 88 D0 E8 D9
C0E8:A5 CB C9 15 F0 77 A2 5A BF
C0F0:20 A1 C0 A5 CB C9 23 D0 F9
C0F8:03 EE 27 D0 C9 38 D0 03 7D
C100:EE 28 D0 C9 3B D0 03 EE CD
C108:29 D0 C9 08 D0 03 EE 2A A8
C110:D0 C9 0B D0 03 EE 2B D0 D7
C118:C9 10 D0 03 EE 2C D0 C9 62
C120:13 D0 03 EE 2D D0 C9 18 09
C128:D0 03 EE 2E D0 C9 14 D0 3C
C130:03 EE 21 D0 C9 1C D0 03 85
C138:EE 20 D0 C9 31 F0 20 C9 49
C140:0D F0 19 C9 24 F0 1B C9 2B
C148:2B F0 0E C9 28 F0 07 C9 D8
C150:3C D0 95 4C 65 C1 4C 98 01
C158:C2 4C A5 C2 4C 9B C1 4C D1
C160:70 C2 4C 87 C2 A0 00 38 9F
```

```
C168:A5 FB E9 C0 85 FB A5 FC 6B
C170:E9 01 85 FC A5 FB 85 22 F3
C178:A5 FC 85 23 B1 FB 91 39 CA
C180:C8 D0 F9 A5 3A C9 32 F0 84
C188:07 E6 FC E6 3A 4C 7C C1 15
C190:A9 30 85 3A A9 00 85 39 DA
C198:4C CC C0 A0 00 B9 4A C3 D6
C1A0:F0 0C 99 03 07 A9 01 99 7D
C1A8:03 DB C8 4C 9D C1 A5 CB 8D
C1B0:C9 0A F0 15 C9 16 F0 35 C8
C1B8:C9 15 F0 1E C9 0E F0 03 D1
C1C0:4C AE C1 20 3F C3 4C E8 DA
C1C8:C0 20 3F C3 18 A5 23 69 DF
C1D0:02 85 11 A5 22 85 10 4C C6
C1D8:FB C1 20 3F C3 18 A5 22 AE
C1E0:69 40 85 10 A5 23 69 00 67
C1E8:85 11 4C FB C1 20 3F C3 8D
C1F0:18 A5 23 69 01 85 11 A5 CA
C1F8:22 85 10 A9 53 85 12 A9 0A
C200:07 85 13 A9 10 85 09 A9 B9
C208:01 85 07 A9 07 85 08 20 69
C210:B2 C2 E6 14 A0 00 84 24 EF
C218:84 C6 20 E4 FF C9 00 F0 FB
C220:F9 C9 0D F0 23 C9 14 D0 FE
C228:0F A5 24 F0 ED C6 24 A4 A9
C230:24 A9 20 91 14 4C 1A C2 18
C238:A4 24 C0 10 F0 DC 91 14 64
C240:99 5E C3 E6 24 4C 1A C2 5A
C248:A9 00 85 9D A9 03 A2 08 D3
C250:A0 FF 20 BA FF A5 24 A2 57
C258:5E A0 53 20 BD FF A6 10 EC
C260:A4 11 A9 22 20 D8 FF 20 58
C268:4C C0 20 3F C3 4C E8 C0 1E
C270:AD 1D D0 F0 09 EE 1D D0 4C
C278:EE 17 D0 4C E8 C0 CE 1D 1F
C280:D0 CE 17 D0 4C E8 C0 AD 47
C288:1C D0 F0 06 EE 1C D0 4C A4
C290:E8 C0 CE 1C D0 4C E8 C0 A0
C298:A9 C0 8D 6B C1 A9 01 8D CF
C2A0:71 C1 4C E8 C0 A9 40 8D 22
C2A8:6B C1 A9 02 8D 71 C1 4C AB
C2B0:E8 C0 18 A5 12 85 16 A5 B0
C2B8:13 69 D4 85 17 A0 00 A9 F9
C2C0:70 91 12 A5 08 91 16 A4 D6
C2C8:09 A9 2D 91 12 A5 08 91 C4
C2D0:16 88 D0 F5 A9 6E A4 09 56
C2D8:C8 91 12 A5 08 91 16 A9 20
C2E0:6D A0 50 91 12 A5 08 91 31
C2E8:16 18 A5 12 69 50 85 12 FE
C2F0:A5 13 69 00 85 13 18 A5 89
C2F8:16 69 50 85 16 A5 17 69 25
C300:00 85 17 A4 09 A9 2D 91 F0
C308:12 A5 08 91 16 88 D0 F5 86
C310:A9 7D A4 09 C8 91 12 A5 47
C318:08 91 16 38 A5 16 E9 28 CF
C320:85 16 A5 17 E9 00 85 17 87
C328:A5 07 A4 09 91 16 88 D0 30
C330:FB 38 A5 12 E9 28 85 14 A8
C338:A5 13 E9 00 85 15 60 A0 76
C340:00 A9 20 99 D0 06 C8 D0 D0
C348:FA 60 C6 49 52 53 54 20 7B
C350:D4 4F 50 20 C1 4C 4C 20 1A
C358:C5 58 49 54 3F 00 00 00 41
```

SpeedScript 128
Date And Time Stamper

See instructions in article on page 71 before typing in.

Program 1: *SpeedScript 128* Date And Time Stamper

```
1300:A9 00 8D 00 FF 20 63 19 0D
1308:A9 08 AA A0 01 20 BA FF 62
1310:A9 0F A2 54 A0 13 20 BD B7
1318:FF A9 00 20 D5 FF 90 01 7B
1320:60 A0 03 B9 76 14 99 08 D9
1328:DD 88 10 F7 78 A2 FD A0 CB
1330:13 8E 14 03 8C 15 03 A2 97
1338:55 A0 15 8E 32 03 8C 33 A6
1340:03 58 A2 63 A0 13 8E 14 0B
1348:29 8C 15 29 A9 FF 8D 75 39
1350:14 4C 0D 1C 53 50 45 45 A2
1358:44 53 43 52 49 50 54 20 57
1360:31 32 38 20 E7 FF A9 00 47
1368:8D 30 D0 20 5D 14 20 7D 76
1370:13 A9 08 8D 69 19 20 22 76
1378:17 20 69 14 60 AE 7A 14 67
1380:BD E5 14 A8 B9 83 14 F0 01
1388:06 20 D2 FF C8 D0 F5 A9 33
1390:00 AE 7B 14 20 FF 14 A9 E5
1398:2C 20 D2 FF 20 1D 17 A2 7D
13A0:13 A9 00 20 FF 14 AE 7C E6
13A8:14 A9 00 20 FF 14 20 1D F2
13B0:17 20 D2 FF A2 20 AD 79 2F
13B8:14 48 29 10 F0 02 A2 31 27
13C0:8A 20 D2 FF 68 20 F5 13 51
13C8:A9 3A 20 D2 FF AD 78 14 3F
13D0:48 4A 4A 4A 4A 20 F5 13 6D
13D8:68 20 F5 13 20 1D 17 A9 78
13E0:41 AC 79 14 C0 80 90 02 6E
13E8:A9 50 20 D2 FF A9 4D 20 8A
13F0:D2 FF 4C 19 17 29 0F 18 2F
13F8:69 30 4C D2 FF A0 03 B9 D8
1400:08 DD 99 76 14 88 10 F7 19
1408:AD 79 14 29 80 D0 46 AD FB
1410:75 14 D0 46 A9 FF 8D 75 54
1418:14 AE 7A 14 E0 02 D0 11 48
1420:A9 1D AC 7C 14 C0 58 F0 07
1428:0B C0 5C F0 07 C0 60 F0 8D
1430:03 BD F2 14 CD 7B 14 D0 3E
1438:17 A0 01 8C 7B 14 EE 7A 81
1440:14 AD 7A 14 C9 0D D0 12 A4
1448:8C 7A 14 EE 7C 14 D0 0A A6
1450:EE 7B 14 D0 05 A9 00 8D BA
1458:75 14 4C 65 FA A0 05 B9 3E
1460:FA 00 99 7D 14 88 10 F7 EB
1468:60 A0 05 B9 7D 14 99 FA 8F
1470:00 88 10 F7 60 00 00 50 8F
1478:00 81 09 1A 56 00 00 00 76
1480:00 00 00 6A 41 4E 55 41 7E
1488:52 59 20 00 66 45 42 52 53
1490:55 41 52 59 20 00 6D 41 B0
1498:52 43 48 20 00 61 50 52 3E
14A0:49 4C 20 00 6D 41 59 20 C7
14A8:00 6A 55 4E 45 20 00 6A 10
14B0:55 4C 59 20 00 61 55 47 3B
14B8:55 53 54 20 00 73 45 50 95
14C0:54 45 4D 42 45 52 20 00 E5
14C8:6F 43 54 4F 42 45 52 20 E4
14D0:00 6E 4F 56 45 4D 42 45 0D
14D8:52 20 00 64 45 43 45 4D 87
14E0:42 45 52 20 00 00 00 09 D0
14E8:13 1A 21 26 2C 32 3A 45 8B
14F0:4E 58 00 1F 1C 1F 1E 1F 01
14F8:1E 1F 1F 1E 1F 1E 1F 8D FA
1500:51 15 8E 52 15 A2 09 8E E2
1508:53 15 A0 B0 AD 52 15 DD FE
1510:46 15 AD 51 15 FD 47 15 B1
1518:90 0F 8D 51 15 AD 52 15 2E
1520:FD 46 15 8D 52 15 C8 D0 9F
1528:E3 98 CA F0 11 C9 B0 F0 D4
1530:03 8D 53 15 2C 53 15 30 04
1538:05 AD 54 15 F0 05 29 7F 99
1540:20 D2 FF CA 10 C4 60 01 31
1548:00 0A 00 64 00 E8 03 10 F4
1550:27 00 00 00 00 A5 BA C9 E3
1558:08 F0 04 4C 4E F5 60 20 33
1560:4E F5 B0 FA A5 90 D0 F6 FC
1568:A2 10 A9 A0 9D F7 16 CA EA
1570:10 FA A0 00 A2 00 B1 BB A9
1578:C8 C9 2C F0 0C C9 3A F0 FA
1580:F3 9D F7 16 E8 C4 B7 90 C6
1588:ED AD 7C 14 38 E9 55 0A 04
1590:0A 0A 0A 18 6D 7A 14 8D 10
1598:F3 16 AD 7B 14 8D F4 16 86
15A0:AD 79 14 8D F5 16 AD 78 37
15A8:14 8D F6 16 20 5D 14 A9 C8
15B0:07 85 FF A9 31 85 FB A9 9B
15B8:16 85 FC A9 00 85 FD A9 45
15C0:05 85 FE A5 BA 20 B1 FF C2
15C8:A9 6F 20 93 FF A5 FD A4 18
15D0:FE 8D 2D 16 8C 2E 16 A0 CE
15D8:00 B9 2A 16 20 A8 FF C8 84
15E0:C0 06 D0 F5 A0 00 B1 FB CA
15E8:20 A8 FF C8 C0 20 90 F6 78
15F0:A5 FB 69 1F 85 FB A5 FC 70
15F8:69 00 85 FC A5 FD 69 20 70
1600:85 FD A5 FE 69 00 85 FE 68
1608:20 AE FF C6 FF D0 B4 A5 AE
1610:BA 20 B1 FF A9 6F 20 93 B6
1618:FF A9 55 20 A8 FF A9 43 37
1620:20 A8 FF 20 AE FF 20 69 A7
1628:14 60 4D 2D 57 00 05 20 D7
1630:EA 20 00 C1 78 A9 12 A0 25
1638:01 8D 00 03 8C 01 03 20 07
1640:76 05 A9 03 85 3C A2 00 B0
1648:86 4B F0 29 A0 00 B1 3B DE
1650:C9 82 D0 19 C8 C8 C8 B9 62
1658:C3 05 C9 2A F0 2E C9 3F 96
1660:F0 04 D1 3B D0 07 C8 C0 E8
1668:13 F0 21 D0 EA E6 4B A6 BB
1670:4B E0 08 F0 07 BD BA 05 34
1678:85 3B D0 D0 AD 00 03 F0 C1
1680:07 AC 01 03 A2 00 F0 B7 5A
1688:58 4C 45 D9 A0 16 A2 00 DC
1690:BD C2 05 91 3B C8 E8 E0 B5
1698:04 D0 F5 A9 90 85 00 58 47
16A0:24 00 30 FC 4C 9E C1 AC C1
16A8:01 03 84 07 AD 00 03 85 10
16B0:06 A9 B0 85 00 58 24 00 62
16B8:30 FC 78 A5 00 C9 01 D0 9F
16C0:24 A9 EE 8D 0C 1C A9 06 4A
16C8:85 32 A9 00 85 33 85 30 AD
16D0:A9 03 85 31 A9 80 85 00 B0
16D8:58 24 00 30 FC 78 A5 00 52
16E0:C9 01 D0 01 60 18 69 18 AA
16E8:4C C8 C1 02 22 42 62 82 27
16F0:A2 C2 E2 28 43 29 20 31 2E
16F8:39 38 36 20 42 4F 42 20 8C
1700:4B 4F 44 41 44 45 4B 00 12
1708:48 38 20 F0 FF 68 A8 18 86
1710:20 F0 FF 60 A9 00 4C FF 76
1718:14 A9 0D D0 02 A9 20 4C AC
1720:D2 FF A9 49 8D 6F 19 A9 87
1728:02 85 FD A9 0F 85 FE 20 BF
1730:3A 19 A9 24 8D 6F 19 A9 3F
1738:04 85 FD A9 00 85 FE 20 58
1740:3A 19 A2 01 20 C6 FF A0 F2
1748:22 20 33 19 20 CF FF 8D 55
1750:6C 19 20 CF FF 8D 6D 19 26
1758:A9 02 85 FE 85 FD 20 3A 1B
1760:19 A2 01 20 C6 FF A0 8E EB
1768:20 33 19 20 7D FF 0D 12 B0
1770:73 50 45 45 44 73 43 52 32
1778:49 50 54 20 31 32 38 92 41
1780:20 00 A2 00 20 CF FF 20 73
1788:D2 FF E8 E0 17 D0 F5 20 53
1790:7D FF 0D 12 42 4C 4B 20 3A
1798:2D 20 46 49 4C 45 4E 41 18
17A0:4D 45 20 20 2D 2D 2D 20 65
17A8:20 54 50 20 2D 20 44 41 BB
17B0:54 45 20 2D 2D 20 54 49 0D
17B8:4D 45 20 0D 00 A0 59 20 09
17C0:33 19 A9 00 8D 6B 19 A9 F9
17C8:00 8D 6A 19 A2 00 A9 14 B5
17D0:20 08 17 20 CF FF 8D 6E FD
17D8:19 20 B7 FF F0 37 20 19 50
17E0:17 AE 6B 19 20 14 17 20 E4
17E8:7D FF 20 46 49 4C 45 53 97
17F0:20 20 00 AE 6C 19 AD 6D B2
17F8:19 20 FF 14 20 7D FF 20 14
1800:42 4C 4F 43 4B 53 20 46 B0
1808:52 45 45 00 20 CC FF A9 39
1810:01 20 C3 FF 60 20 E1 FF 88
1818:F0 F2 AD 6E 19 D0 08 A0 D6
1820:1D 20 33 19 4C 1D 19 29 11
1828:80 D0 04 A9 2A D0 02 A9 2A
1830:20 20 D2 FF AD 6E 19 29 55
1838:07 0A A8 A2 00 B9 72 19 92
1840:20 D2 FF C8 E8 E0 02 D0 61
1848:F4 AD 6E 19 29 40 F0 05 EE
1850:A9 3C 20 D2 FF 20 CF FF B5
1858:20 CF FF A9 04 20 08 17 EE
1860:A2 00 20 CF FF C9 A0 D0 1C
1868:02 A9 2D 20 D2 FF E8 E0 F4
1870:10 D0 EF A0 03 20 33 19 FC
1878:A9 18 20 08 17 20 CF FF E0
1880:D0 08 A0 05 20 33 19 4C CB
1888:06 19 48 29 0F AA E0 0A 8C
1890:B0 03 20 1D 17 20 14 17 28
```

```
1898:A9 2D 20 D2 FF 20 CF FF 3A
18A0:AA E0 0A B0 05 A9 30 20 F9
18A8:D2 FF 20 14 17 A9 2D 20 61
18B0:D2 FF 68 4A 4A 4A 4A 18 24
18B8:69 55 AA 20 14 17 A9 21 BB
18C0:20 08 17 20 CF FF 48 A2 99
18C8:20 29 10 F0 02 A2 31 8A EB
18D0:20 D2 FF 68 48 29 0F AA FB
18D8:20 14 17 A9 3A 20 D2 FF 93
18E0:20 CF FF 48 4A 4A 4A 4A F3
18E8:AA 20 14 17 68 29 0F AA 1B
18F0:20 14 17 A2 41 68 29 80 C1
18F8:F0 02 A2 50 8A 20 D2 FF F5
1900:20 CF FF 20 CF FF A9 00 0A
1908:20 08 17 20 CF FF AA 20 25
1910:CF FF 20 FF 14 A9 0D 20 AF
1918:D2 FF EE 6B 19 EE 6A 19 BA
1920:AD 6A 19 C9 08 D0 03 4C 59
1928:C7 17 20 CF FF 20 CF FF 25
1930:4C CC 17 20 CF FF 88 D0 01
1938:FA 60 20 CC FF A9 01 20 99
1940:C3 FF 20 63 19 A9 01 AE AE
1948:69 19 A4 FE 20 BA FF A5 8B
1950:FD A2 6F A0 19 20 BD FF E6
1958:20 C0 FF 90 05 68 68 4C BA
1960:0C 18 60 A9 00 AA 4C 68 F0
1968:FF 00 00 00 00 00 00 24 BE
1970:30 3A 44 4C 53 51 50 47 5E
1978:55 52 52 4C EA EA EA EA BC
```

Program 2: Date And Time Loader

```
BE 10 REM COPYRIGHT 1987 COMPU
      TE! PUBLICATIONS INC. -
      {SPACE}ALL RIGHTS RESERV
      ED
KG 20 IFPEEK(215)=0THENPRINT"S
      WITCHING TO 80 COLUMNS":
      PRINTCHR$(27)+"X"
JG 30 PRINT"{CLR}"CHR$(14)TAB(
      19)"COPYRIGHT 1987 COMPU
      TE! PUBLICATIONS, INC."
JX 40 PRINTTAB(30)"ALL RIGHTS
      {SPACE}RESERVED"
RQ 50 PRINTSPC(182)"SPEEDSCRIP
      T 128 DATE & TIME STAMPE
      R"
MF 60 TRAP300:BLOAD"SS128 DATE
      /TIME"
DQ 70 ML=4864:CL=5240:U$=CHR$(
      145)+CHR$(145)
CF 80 PRINTSPC(160)"SET THE DA
      TE":PRINT
DX 90 INPUT"MONTH{2 SPACES}(1-
      12){5 SPACES}{5 LEFT}";M
      N
BC 100 IFMN<1ORMN>12THENPRINTU
      $:GOTO90
DQ 110 INPUT"{2 SPACES}DAY
      {2 SPACES}(1-31)
      {5 SPACES}{5 LEFT}";DT
BJ 120 IFDT<1ORDT>31THENPRINTU
      $:GOTO110
GK 130 INPUT" YEAR (86-99)
      {5 SPACES}{5 LEFT}";YR
AX 140 IFYR<86ORYR>99THENPRINT
      U$:GOTO130
AH 150 PRINTSPC(80)"SET THE TI
      ME":PRINT
GK 160 INPUT"HOURS{2 SPACES}(1
      -12){5 SPACES}{5 LEFT}"
      ;HR
JJ 170 IFHR<1ORHR>12THENPRINTU
      $:GOTO160
ES 180 INPUT" MINS{2 SPACES}(0
      -59){5 SPACES}{5 LEFT}"
      ;MS
EH 190 IFMS>59THENPRINTU$:GOTO
      180
DS 200 INPUT"AM-PM{3 SPACES}(A
      /P){5 SPACES}{5 LEFT}";
      PS
MP 210 IFP$<>"A"ANDP$<>"P"THEN
      PRINTU$:GOTO200
QH 220 FLAG=128:IFP$="A"ANDHR<
      12THENFLAG=0
FK 230 IFP$="P"ANDHR=12THENFLA
      G=0
BD 240 BY=HR:GOSUB310:HR=BYORF
      LAG
KA 250 BY=MS:GOSUB310:MS=BY
CC 260 POKECL,MS:POKECL+1,HR:P
      OKECL+2,MN
SC 270 POKECL+3,DT:POKECL+4,YR
SF 280 PRINT:PRINT"PUT 'SPEEDS
      CRIPT 128' DISK IN DRIV
      E 0, UNIT 8."
DD 290 PRINT:PRINT"WHEN READY,
       PRESS <RETURN>.":SYS 6
      5487:SYSML
MX 300 PRINT:PRINTDS$:END
ED 310 X=INT(BY/10):Y=BY-10*X:
      BY=16*X+Y:RETURN
```

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," elsewhere in this issue.

Barricade Buster

See instructions in article on page 74 before typing in.

Program 1: Barricade Buster—128 Version

```
1300:00 00 00 4C 1B 13 20 3A 8A
1308:13 20 2B 13 AD 00 13 8D 77
1310:01 D6 60 AD 00 D6 29 80 81
1318:F0 F9 60 20 3A 13 20 13 B4
1320:13 20 2B 13 AD 01 D6 8D 1B
1328:00 13 60 AD 01 13 8D 01 6A
1330:D6 A9 1F 8D 00 D6 20 13 97
1338:13 60 A9 12 8D 00 D6 20 90
1340:13 13 AD 02 13 8D 01 D6 32
1348:A9 13 8D 00 D6 60 00 00 F1
```

Program 2: Barricade Buster—64 Version

See instructions in article on page 74 before typing in.

```
0334:00 00 00 4C 4F 03 20 6E 34
033C:03 20 5F 03 AD 34 03 8D B9
0344:01 D6 60 AD 00 D6 29 80 95
034C:F0 F9 60 20 6E 03 20 47 5E
0354:03 20 5F 03 AD 01 D6 8D AC
035C:34 03 60 AD 35 03 8D 01 F5
0364:D6 A9 1F 8D 00 D6 20 47 DF
036C:03 60 A9 12 8D 00 D6 20 9C
0374:47 03 AD 36 03 8D 01 D6 1F
037C:A9 13 8D 00 D6 60 00 00 06
```

Program 3: Barricade Buster Demo—Pizza Raid

See instructions in article on page 74 before typing in.

```
1300:00 00 00 4C 1B 13 20 3A 8A
1308:13 20 2B 13 AD 00 13 8D 77
1310:01 D6 60 AD 00 D6 29 80 81
1318:F0 F9 60 20 3A 13 20 13 B4
1320:13 20 2B 13 AD 01 D6 8D 1B
1328:00 13 60 AD 01 13 8D 01 6A
1330:D6 A9 1F 8D 00 D6 20 13 97
1338:13 60 A9 12 8D 00 D6 20 90
1340:13 13 AD 02 13 8D 01 D6 32
1348:A9 13 8D 00 D6 60 A9 93 D8
1350:20 D2 FF A9 05 85 D8 20 E5
1358:59 6B A9 14 8D 39 14 8D 83
1360:38 14 A9 01 8D 36 14 8D E7
1368:37 14 8D 30 D0 A9 FF 8D 9E
1370:0E D4 8D 0F D4 A9 80 8D 51
1378:12 D4 A9 93 20 D2 FF 20 B7
1380:90 14 20 06 16 4C 88 13 5E
1388:20 F8 15 20 3A 14 A9 51 68
1390:8D 00 13 20 06 13 EE EE 2B
1398:14 AD EE 14 C9 10 90 06 09
13A0:20 EF 14 4C A9 13 20 2B 1F
13A8:14 20 3A 14 A9 20 8D 00 52
13B0:13 20 06 13 AD 38 14 C9 9A
13B8:07 90 19 C9 4E B0 15 AD 53
13C0:39 14 C9 01 90 0E C9 17 39
13C8:B0 0A AD 1B D4 C9 01 B0 B1
13D0:03 20 86 16 AC 38 14 AD CE
13D8:36 14 F0 08 88 C0 05 B0 BF
13E0:0E 20 81 14 C8 C0 4F 90 FF
13E8:06 20 81 14 4C DC 13 8C 14
13F0:38 14 20 3A 14 20 1B 13 4A
13F8:C9 20 F0 03 20 72 14 AE FB
1400:39 14 AD 37 14 F0 06 CA 2E
1408:D0 0E 20 72 14 E8 E0 18 65
1410:90 06 20 72 14 4C 07 14 21
1418:8E 39 14 20 3A 14 20 1B D7
1420:13 C9 20 F0 03 20 81 14 07
1428:4C 88 13 A2 00 A0 10 CA 92
1430:D0 FD 88 D0 FA 60 00 00 B7
1438:00 00 AE 39 14 20 69 14 D1
1440:AC 38 14 E0 00 F0 11 AD F0
1448:01 13 18 69 50 8D 01 13 1D
1450:90 03 EE 02 13 CA D0 EF D4
1458:AD 01 13 18 98 6D 01 13 0B
1460:8D 01 13 90 03 EE 02 13 E5
1468:60 A9 00 8D 01 13 8D 02 75
1470:13 60 AD 37 14 F0 06 A9 7D
1478:00 8D 37 14 60 A9 01 D0 A8
1480:F8 AD 36 14 F0 06 A9 00 8B
1488:8D 36 14 60 A9 01 D0 F8 79
1490:A2 00 A9 30 9D DB 14 E8 AF
1498:E0 12 90 F6 A9 02 8D 02 A9
14A0:13 A9 98 8D 01 13 A9 5F AF
14A8:8D 00 13 A2 00 A0 00 20 C6
14B0:06 13 AD 01 13 18 69 01 33
14B8:8D 01 13 90 03 EE 02 13 3E
14C0:E8 E0 20 90 EA A2 00 AD 32
14C8:01 13 18 69 30 8D 01 13 9C
14D0:90 03 EE 02 13 C8 C0 08 45
14D8:90 D5 60 00 30 30 30 30 9D
14E0:30 30 30 30 30 30 30 30 09
14E8:30 30 30 30 30 30 00 A9 2A
14F0:02 8D 02 13 A9 98 8D 01 BA
14F8:13 A9 00 8D EE 14 AA A8 B3
1500:8D DB 14 20 1B 13 C9 5F 84
1508:D0 03 EE DB 14 AD 01 13 63
1510:18 69 01 8D 01 13 90 03 12
1518:EE 02 13 E8 E0 20 90 E3 B7
1520:A2 00 AD 01 13 18 69 30 5D
1528:8D 01 13 90 03 EE 02 13 AF
1530:C8 C0 08 90 CE AC DB 14 ED
1538:C0 80 90 6E A2 06 FE DC E3
1540:14 BD DC 14 C9 3A 90 09 22
1548:A9 30 9D DC 14 CA 4C 3E 77
1550:15 88 D0 E8 A2 00 A9 30 68
1558:9D EB 14 E8 E0 03 90 F8 8A
1560:AC DB 14 A2 02 FE EB 14 7C
1568:BD EB 14 C9 3A 90 09 A9 5B
1570:30 9D EB 14 CA 4C 65 15 40
1578:88 D0 E8 A2 00 20 69 14 C9
1580:BD DC 14 8D 00 13 20 06 AE
1588:13 E8 EE 01 13 E0 07 90 1F
1590:EF A2 00 A9 4D 8D 01 13 AB
1598:BD EB 14 8D 00 13 20 06 8A
15A0:13 E8 EE 01 13 E0 03 90 2F
15A8:EF 60 A5 D4 C9 01 D0 FA D3
15B0:4C 4E 13 20 06 13 AD 01 D1
15B8:13 18 69 01 8D 01 13 90 D6
15C0:03 EE 02 13 60 20 06 13 3C
15C8:AD 01 13 18 69 50 8D 01 96
15D0:13 90 03 EE 02 13 60 A9 BE
```

```
15D8:02 8D 02 13 A9 97 8D 01 A0
15E0:13 60 A9 05 8D 02 13 A9 76
15E8:17 8D 01 13 60 A9 02 8D 8E
15F0:02 13 A9 B7 8D 01 13 60 88
15F8:A5 D4 C9 02 D0 03 4C 46 F5
1600:16 C9 07 F0 01 60 20 D7 3B
1608:15 A2 00 A9 63 8D 00 13 66
1610:20 B3 15 E8 E0 21 90 F8 10
1618:20 E2 15 A9 64 8D 00 13 B6
1620:20 B3 15 E8 E0 42 90 F8 A4
1628:20 D7 15 A2 00 A9 20 8D 9B
1630:00 13 20 C5 15 E8 E0 09 98
1638:90 F8 20 ED 15 20 C5 15 97
1640:E8 E0 12 90 F8 60 20 D7 C5
1648:15 A2 00 A9 20 8D 00 13 8C
1650:20 B3 15 E8 E0 21 90 F8 50
1658:20 E2 15 20 B3 15 E8 E0 96
1660:42 90 F8 20 D7 15 A2 00 4B
1668:A9 67 8D 00 13 20 C5 15 AE
1670:E8 E0 09 90 F8 20 ED 15 AC
1678:A9 65 8D 00 13 20 C5 15 3E
1680:E8 E0 12 90 F8 60 AD 1B 64
1688:D4 29 80 F0 0C 29 40 F0 FE
1690:13 29 20 F0 1A 29 1F D0 28
1698:2B AD 1B D4 09 05 29 3F 64
16A0:8D 38 14 60 6D 1B D4 09 B4
16A8:01 29 0F 8D 39 14 60 6D A2
16B0:1B D4 29 01 D0 03 20 81 29
16B8:14 4D 1B D4 29 01 D0 03 E4
16C0:20 72 14 60 AD 39 14 69 06
16C8:02 8D 39 14 AD 38 14 69 A1
16D0:01 8D 38 14 60 00 00 00 2C
```

Renumber 64

See instructions in article on page 72 before typing in.

```
C000:4C 85 C0 4C 2C C0 78 A9 E4
C008:31 8D 14 03 A9 EA 8D 15 61
C010:03 58 A9 19 A0 C0 4C 1E AE
C018:AB 0D 52 45 4E 55 4D 42 F5
C020:45 52 20 44 49 53 41 42 7D
C028:4C 45 44 00 78 A9 59 8D 54
C030:14 03 A9 C0 8D 15 03 58 DC
C038:20 73 C4 A9 00 8D 34 03 7B
C040:A9 47 A0 C0 4C 1E AB 0D C7
C048:52 45 4E 55 4D 42 45 52 B3
C050:20 45 4E 41 42 4C 45 44 23
C058:00 A5 9D 10 0A A5 C5 C9 34
C060:04 F0 07 A9 00 85 06 4C 0A
C068:31 EA 24 06 30 F9 C6 06 1F
C070:2C 34 03 30 F2 A9 80 8D 45
C078:34 03 20 A0 C0 A9 00 8D 1D
C080:34 03 4C 31 EA 20 8C C4 2F
C088:AD 35 03 8D CF C4 AD 36 8A
C090:03 8D D0 C4 AD 37 03 8D 3B
C098:D1 C4 AD 38 03 8D D2 C4 26
C0A0:A5 7A 48 A5 7B 48 A9 00 47
C0A8:8D 3B 03 8D 3C 03 A5 2B 5D
C0B0:85 02 A5 2C 85 03 A9 D3 4C
C0B8:38 E9 02 85 04 A9 C4 E9 A3
C0C0:00 85 05 A0 00 B1 02 C8 E1
C0C8:11 02 F0 2C C8 B1 02 91 D6
C0D0:04 C8 B1 02 91 04 A0 00 BA
C0D8:B1 02 48 C8 B1 02 85 03 EC
C0E0:68 85 02 A5 04 18 69 02 E7
C0E8:85 04 90 02 E6 05 EE 3B C4
C0F0:03 D0 D0 EE 3C 03 D0 CB 8C
C0F8:AD 3B 03 0D 3C 03 D0 03 E3
C100:4C 68 C4 AD 3B 03 85 FD 26
C108:AD 3C 03 85 FE AD 35 03 46
C110:8D 39 03 AD 36 03 8D 3A F6
C118:03 C9 FA B0 2A A5 FD 38 16
C120:E9 01 85 FD A5 FE E9 00 66
C128:85 FE 05 FD F0 4F AD 39 08
C130:03 18 6D 37 03 8D 39 03 20
C138:AD 3A 03 6D 38 03 8D 3A 7B
C140:03 B0 04 C9 FA 90 D6 68 BE
C148:85 7B 68 85 7A A9 54 A0 96
C150:C1 4C 1E AB 0D 4E 45 57 C9
C158:20 4E 55 4D 42 45 52 53 1E
C160:20 54 4F 4F A0 48 49 47 E7
C168:48 3A 20 52 45 4E 55 4D 23
C170:42 45 52 20 41 42 4F 52 B6
C178:54 45 44 0D 00 A5 2B 85 43
C180:7A 85 FB A5 2C 85 7B 85 70
C188:FC A9 03 18 65 7A 85 7A 71
C190:90 02 E6 7B 20 73 00 C9 0A
C198:00 F0 25 C9 CB D0 0B 20 71
C1A0:73 00 C9 00 F0 1A C9 A4 3F
C1A8:F0 2E C9 89 F0 2A C9 8D 53
C1B0:F0 26 C9 A7 F0 22 C9 8A 18
C1B8:F0 1E C9 9B F0 1A D0 D4 95
C1C0:A0 01 B1 FB F0 0F 85 7B 15
C1C8:48 88 B1 FB 85 7A 85 FB A5
C1D0:68 85 FC D0 B4 4C 0C C4 4A
C1D8:A5 7A 8D 46 03 A5 7B 8D 17
C1E0:47 03 A9 00 8D 3D 03 85 EA
C1E8:14 85 15 20 73 00 C9 2C D7
C1F0:D0 03 4C D8 C1 20 79 00 36
C1F8:4C FE C1 20 73 00 B0 09 A2
C200:C9 3A B0 05 EE 3D 03 D0 A2
C208:F2 AD 3D 03 8D 41 03 D0 92
C210:1B 20 79 00 4C 97 C1 A5 44
C218:7A 8D 44 03 A5 7B 8D 45 72
C220:03 AD 46 03 85 7A AD 47 44
C228:03 85 7B 60 20 17 C2 20 09
C230:73 00 38 E9 30 85 07 A5 60
C238:15 85 22 C9 19 90 06 20 C1
C240:79 00 4C 97 C1 A5 14 0A 5C
C248:26 22 0A 26 22 65 14 85 61
C250:14 A5 22 65 15 85 15 06 D2
C258:14 26 15 A5 14 65 07 85 38
C260:14 90 02 E6 15 CE 41 03 2C
C268:D0 C5 AD 44 03 38 ED 46 DC
C270:03 A8 88 AD 46 03 85 02 D8
C278:AD 47 03 85 03 A9 20 91 EF
C280:02 88 D0 FB A9 D3 85 04 AE
C288:A9 C4 85 05 AD 3B 03 85 FA
C290:FD AD 3C 03 85 FE AD 35 F0
C298:03 8D 42 03 AD 36 03 8D 55
C2A0:43 03 A0 00 B1 04 C5 14 D9
C2A8:F0 3B AD 42 03 18 6D 37 D9
C2B0:03 8D 42 03 AD 43 03 6D 81
C2B8:38 03 8D 43 03 A5 04 18 CF
C2C0:69 02 85 04 90 02 E6 05 CB
C2C8:A5 FD 38 E9 01 85 FD A5 06
C2D0:FE E9 00 85 FE 05 FD D0 81
C2D8:C9 A9 FF 8D 42 03 A9 F9 F1
C2E0:8D 43 03 D0 09 C8 B1 04 3E
C2E8:C5 15 F0 02 D0 BC AD 43 EC
C2F0:03 AE 42 03 85 62 86 63 42
C2F8:A2 90 38 20 49 BC 20 DF 5A
C300:BD A9 00 8D 3E 03 85 7A 2D
C308:A9 01 85 7B EE 3E 03 20 A3
C310:73 00 C9 00 D0 F6 AD 3E 86
C318:03 38 ED 3D 03 8D 3F 03 90
C320:A9 00 E9 00 8D 40 03 AD DA
C328:3F 03 D0 03 4C D8 C3 AD 55
C330:44 03 85 5F AD 45 03 85 4F
C338:60 A5 2D 85 5A A5 2E 85 A2
C340:5B AD 40 03 30 49 A5 5F 6A
C348:38 E9 01 85 5F A5 60 E9 1B
C350:00 85 60 A5 5A 38 E9 01 28
C358:85 5A A5 5B E9 00 85 5B 59
C360:A5 5A C5 5F D0 06 A5 5B 45
C368:C5 60 F0 0B A0 00 B1 5A 7C
C370:AC 3F 03 91 5A D0 DC A0 08
C378:00 B1 5A AC 3F 03 91 5A 06
C380:AC 3F 03 88 F0 3B A9 20 FE
C388:91 5F 88 D0 FB F0 32 AD 84
C390:3F 03 49 FF 85 02 E6 02 A5
C398:A5 5F 18 6D 3F 03 85 5F 15
C3A0:A5 60 6D 40 03 85 60 A4 58
C3A8:02 B1 5F A0 00 91 5F E6 7F
C3B0:5F D0 02 E6 60 A5 5F C5 E8
C3B8:5A D0 EC A5 60 C5 5B D0 3B
C3C0:E6 A5 2D 18 6D 3F 03 85 40
C3C8:2D 85 2F 85 31 A5 2E 6D 70
C3D0:40 03 85 2E 85 30 85 32 F6
C3D8:AD 46 03 85 7A AD 47 03 9D
C3E0:85 7B A0 01 B9 FF 00 F0 EC
C3E8:05 91 7A C8 D0 F6 20 33 09
C3F0:A5 A5 7A 18 6D 3E 03 85 75
C3F8:7A A5 7B 69 00 85 7B 20 5A
C400:73 00 C9 2C F0 03 4C 97 03
C408:C1 4C D8 C1 A5 2B 85 02 A3
C410:A5 2C 85 03 AD 35 03 8D 2E
C418:42 03 AD 36 03 8D 43 03 74
C420:AD 3B 03 85 FD AD 3C 03 2A
C428:85 FE A0 02 AD 42 03 91 76
C430:02 C8 AD 43 03 91 02 A0 D9
C438:00 B1 02 48 C8 B1 02 85 89
C440:03 68 85 02 AD 42 03 18 CA
C448:6D 37 03 8D 42 03 AD 43 4C
C450:03 6D 38 03 8D 43 03 A5 13
C458:FD 38 E9 01 85 FD A5 FE AA
C460:E9 00 85 FE 05 FD D0 C2 04
C468:68 85 7B 68 85 7A A9 00 E6
C470:85 3E 60 AD CF C4 8D 35 15
C478:03 AD D0 C4 8D 36 03 AD 4E
C480:D1 C4 8D 37 03 AD D2 C4 82
C488:8D 38 03 60 20 73 C4 20 C5
C490:06 E2 20 B6 C4 A5 64 8D 58
C498:36 03 A5 65 8D 35 03 20 70
C4A0:06 E2 20 B6 C4 A5 64 05 DF
C4A8:65 F0 21 A5 64 8D 38 03 6C
C4B0:A5 65 8D 37 03 60 20 FD 63
C4B8:AE 20 8A AD 20 9B BC A5 5C
C4C0:62 05 63 D0 07 A5 64 C9 97
C4C8:FA B0 01 60 4C 48 B2 64 6F
C4D0:00 0A 00 00 00 00 00 00 DC
```

Power BASIC: Crystal Clear

Article on page 81.

Program 1: Crystal Clear

```
KC 10 REM COPYRIGHT 1987 COMPU
      TE! PUBLICATIONS, INC. -
       ALL RIGHTS RESERVED
DE 20 PRINT"{CLR}{3 SPACES}COP
      YRIGHT 1987 COMPUTE! PUB
      ., INC."
RD 30 PRINTTAB(10)"ALL RIGHTS
      {SPACE}RESERVED"
BJ 40 FORI=49152TO49633:READA:
      POKEI,A:X=X+A:NEXT
EA 50 IFX<>58435THENPRINT"ERRO
      R IN DATA STATEMENTS.":S
      TOP
AA 60 DATA76,177,192,76,191,19
      2
JK 70 DATA76,203,192,76,217,19
      2
PX 80 DATA76,246,192,76,4,193
KX 90 DATA76,76,193,76,88,193
MB 100 DATA76,152,193,76,166,1
       93
QH 110 DATA165,251,133,105,165
       ,252
XG 120 DATA133,106,165,2,133,1
       07
JK 130 DATA32,89,192,165,253,1
       45
HF 140 DATA108,165,254,145,110
       ,198
KQ 150 DATA107,240,31,165,108,
       24
DE 160 DATA109,16,193,133,108,
       165
MJ 170 DATA109,105,0,133,109,1
       65
BM 180 DATA110,24,109,16,193,1
       33
KR 190 DATA110,165,111,105,0,1
       33
FC 200 DATA111,76,45,192,96,16
       9
SR 210 DATA0,133,39,165,106,13
       3
RS 220 DATA38,10,38,39,10,38
XC 230 DATA39,10,38,39,133,40
SJ 240 DATA165,39,133,41,165,4
       0
```

```
PH 250 DATA10,38,39,10,38,39
JK 260 DATA24,101,40,133,38,16
       5
PS 270 DATA39,101,41,133,39,16
       9
JA 280 DATA0,24,101,38,133,108
KG 290 DATA169,4,101,39,133,10
       9
RB 300 DATA169,0,24,101,38,133
AP 310 DATA110,169,216,101,39,
       133
CD 320 DATA111,164,105,96,32,1
       78
JF 330 DATA193,169,40,141,16,1
       93
EX 340 DATA169,0,133,252,169,2
       5
KG 350 DATA133,2,96,32,160,192
RR 360 DATA162,0,32,187,193,23
       2
EP 370 DATA224,20,208,248,96,3
       2
GX 380 DATA160,192,162,19,32,1
       87
RR 390 DATA193,202,16,250,96,3
       2
QJ 400 DATA160,192,162,0,32,19
       8
HP 410 DATA193,232,224,40,208,
       248
AH 420 DATA96,32,160,192,162,3
       9
EM 430 DATA32,198,193,202,16,2
       50
BC 440 DATA96,32,178,193,169,1
SS 450 DATA141,16,193,169,0,13
       3
HK 460 DATA251,169,40,133,2,96
KE 470 DATA32,229,192,162,0,32
EP 480 DATA206,193,232,224,25,
       208
FB 490 DATA248,96,32,229,192,1
       62
DC 500 DATA24,32,206,193,202,1
       6
QC 510 DATA250,96,0,0,173,12
AC 520 DATA3,141,17,193,240,15
SF 530 DATA173,17,208,48,251,1
       73
DP 540 DATA17,208,16,251,206,1
       7
HG 550 DATA193,208,241,96,32,6
       8
CP 560 DATA193,32,30,192,76,68
XD 570 DATA193,32,60,193,32,30
KA 580 DATA192,76,60,193,169,2
       4
AX 590 DATA56,229,252,133,252,
       96
BD 600 DATA169,39,56,229,251,1
       33
AC 610 DATA251,96,32,229,192,1
       62
RJ 620 DATA12,32,214,193,202,1
       6
CR 630 DATA250,96,32,229,192,1
       62
DE 640 DATA0,32,214,193,232,22
       4
BJ 650 DATA13,208,248,96,138,1
       33
XB 660 DATA252,133,251,169,40,
       141
HM 670 DATA16,193,169,25,56,.22
       9
BC 680 DATA252,56,229,252,133,
       2
RC 690 DATA32,30,192,32,42,193
DQ 700 DATA169,1,141,16,193,16
       9
MX 710 DATA40,56,229,252,56,22
       9
MK 720 DATA252,133,2,32,30,192
EQ 730 DATA32,51,193,76,18,193
BF 740 DATA32,229,192,162,0,32
QC 750 DATA102,193,232,224,13,
       208
FA 760 DATA248,96,32,229,192,1
       62
JG 770 DATA12,32,102,193,202,1
       6
QB 780 DATA250,96,134,253,132,
       254
XR 790 DATA169,19,76,202,241,1
       34
HG 800 DATA251,32,30,192,32,42
XE 810 DATA193,76,18,193,134,2
       51
RX 820 DATA32,30,192,76,18,193
SD 830 DATA134,252,32,30,192,7
       6
RX 840 DATA18,193,134,252,32,3
       0
BK 850 DATA192,32,51,193,76,18
RB 860 DATA193,193,202,16,250,
       96
```

Program 2: Crystal Clear—Demo Program

```
KC 10 REM COPYRIGHT 1987 COMPU
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      ALL RIGHTS RESERVED
JB 20 X=780:Y=781:Z=782:FORI=0
      TO9:A(I)=49152+3*I:NEXT:
      POKE53280,0:POKE53281,0
SR 30 PRINTCHR$(14)"{CLR}{43
      {3 SPACES}COPYRIGHT 1987
      COMPUTE! PUB., INC."
AS 40 PRINTTAB(10)"ALL RIGHTS
      {SPACE}RESERVED"
BE 50 PRINT"{2 DOWN}{83}CRYSTAL
      CLEAR IS A MACHINE LANG
      UAGE"
CX 60 PRINT"{DOWN}ROUTINE THAT
      WILL SPRUCE UP YOUR BAS
      IC"
MC 70 PRINT"{DOWN}AND MACHINE
      {SPACE}LANGUAGE PROGRAMS
      IT ALLOWS";
PE 80 PRINT"{DOWN}YOU TO CLEAR
      THE SCREEN WITH TEN"
AB 90 PRINT"{DOWN}DIFFERENT PA
      TTERNS.{2 SPACES}YOU ALS
      O HAVE"
DH 100 PRINT"{DOWN}CONTROL OVE
       R THE SPEED, PRINT CHAR
       ACTER,"
SC 110 PRINT"AND THE COLOR."
CH 120 PRINT"{2 DOWN}FIRST, LE
       T'S LOOK AT THE PATTERN
       S.{2 DOWN}":GOSUB450
JB 130 POKEX,3:POKEY,32:POKEZ,
       0:SYSA(0):PRINTCHR$(142
       )
CQ 140 FOR I=2 TO 12:POKE X,2:
       POKE Y,160:POKE Z,I:J=J
       +1:IF J>9 THEN J=0
HD 150 SYSA(0)+J*3:NEXT I:POKE
       X,1:POKEY,32:POKEZ,0:SY
       SA(9)
HC 160 PRINTCHR$(14)"{2 DOWN}
       {83}CRYSTAL CLEAR ALLOWS
        YOU TO USE ANY"
GX 170 PRINT"{DOWN}COLOR OR CH
       ARACTER AVAILABLE. THER
       E"
AX 180 PRINT"{DOWN}ARE PRACTIC
       ALLY ENDLESS COMBINATIO
       NS."
SB 190 PRINT"{DOWN}YOU CAN USE
        ONE ROUTINE OR TWO OR
       {SPACE}MORE"
DB 200 PRINT"IN SUCCESSION TO
       {SPACE}PRODUCE DAZZLING
       "
SP 210 PRINT"{DOWN}DISPLAYS.
       {4 DOWN}":GOSUB450:GOSU
       B480:POKE 53272,21
MS 220 FOKEX,3:POKEY,120:POKEZ
       ,6:SYSA(1):PRINTCHR$(14
       2)
AD 230 POKEX,3:POKEY,121:POKEZ
       ,14:SYSA(0):GOSUB480
XJ 240 FOR D=1TO7:POKE X,1:POK
       E Y,86:POKE Z,D:SYSA(8)
FS 250 POKEX,1:POKEY,32:SYSA(9
       ):NEXTD:GOSUB480:POKE 5
       3272,23
BB 260 POKEX,2:POKEY,95:POKEZ,
       15:SYSA(9)
KG 270 POKEX,2:POKEY,105:POKEZ
       ,12:SYSA(9):GOSUB480
AB 280 POKEX,2:POKEY,123:POKEZ
       ,7:SYSA(7)
BX 290 POKEX,2:POKEY,97:POKEZ,
       6:SYSA(6)
EX 300 POKEX,2:POKEY,124:POKEZ
       ,7:SYSA(7):GOSUB480
BB 310 POKEX,1:POKEY,127:POKEZ
       ,1:SYSA(2)
BD 320 POKEX,2:POKEY,32:POKEZ,
       0:SYSA(3)
QF 330 POKEX,1:POKEY,127:POKEZ
       ,1:SYSA(3)
HC 340 POKEX,2:POKEY,32:POKEZ,
       0:SYSA(2)
GJ 350 POKEX,1:POKEY,127:POKEZ
       ,1:SYSA(4)
CD 360 POKEX,1:POKEY,32:POKEZ,
       0:SYSA(5):GOSUB480
JH 370 FORM=1TO6:POKEX,1:POKEY
       ,91:POKEZ,M:SYSA(9):NEX
       T
JR 380 POKEX,1:POKEY,32:POKEZ,
       0:SYSA(8)
BS 390 PRINTCHR$(14)"{83}
       {6 DOWN}{3 RIGHT}NOW WE
       'LL TAKE A JOURNEY THRO
       UGH"
BX 400 PRINT"{DOWN}{3 RIGHT}TH
       E CHARACTER SET AT FULL
        SPEED!{4 DOWN}"
ES 410 GOSUB450:PRINT"{CLR}"CH
       R$(142)
HX 420 FOR I=0 TO 255:POKE X,0
       :POKE Y,I:POKE Z,I:J=J+
       1:IF J>9 THEN J=0
JX 430 SYS49152+J*3:NEXT I
EC 440 POKE X,2:POKE Y,32:POKE
        Z,0:SYS49152+9*3:POKE5
       3272,21:END
PX 450 PRINTSPC(6)"{RVS}{GRN}P
       RESS ANY KEY TO CONTINU
       E"{26 SPACES}"
RF 460 GETDH$:IF DH$=""THEN460
RE 470 RETURN
SH 480 POKEX,2:POKEY,32:POKEZ,
       0:SYSA(9):FORD=1TO1000:
       NEXT
FF 490 RETURN
```

Top Secret

Article on page 76.

```
KC 10 REM COPYRIGHT 1987 COMPU
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XP 20 DIMB(27),C(27),D(27):PRI
      NT"{CLR}{3 SPACES}COPYRI
      GHT 1987 COMPUTE! PUB.,
      {SPACE}INC."
DH 30 PRINTTAB(10)"ALL RIGHTS
```

```
      {SPACE}RESERVED":PRINT"
      {DOWN}PLEASE WAIT...READ
      ING ML"
XS 35 FORI=0TO501:READW:Z=Z+W:
      NEXT
RD 40 IFZ<>46272THENPRINT"ERRO
      R IN DATA STATEMENTS":ST
      OP
HA 50 RESTORE:A=PEEK(43)+256*P
      EEK(44):FORI=0TO27:READB
      (I),C(I),D(I):NEXT
SK 60 DATA12,17,1,32,37,1,1,38
      7,2,68,57,1
BP 70 DATA71,418,4,117,83,1,13
      5,398,2,146,151,1,167,17
      9,5,177,247,1,180,262,1
FB 80 DATA185,343,1,201,366,1,
      209,353,1,212,179,1,242,
      251,1,263,418,4,348,270,
      1
CG 90 DATA362,253,1,378,383,1,
      283,295,5,293,247,1,296,
      262,1,301,343,1,306,366,
      1
XC 100 DATA330,366,1,338,353,1
      ,341,295,1
QD 110 FORI=ATOA+417:READW:POK
      EI,W:NEXT
XM 120 FORI=0TO27:B(I)=B(I)+A:
      C(I)=C(I)+A:HI=INT(C(I)
      /256):LO=C(I)-256*HI
BX 130 POKEB(I),LO:POKEB(I)+D(
      I),HI:NEXT
QQ 140 HI=INT(C(4)/256):LO=C(4
      )-256*HI:POKEA+324,LO
CD 150 X=A+675:HI=INT(X/256):L
      O=X-256*HI
QE 160 POKE43,LO:POKE44,HI:POK
      EX-1,0
EJ 170 PRINT"{DOWN}TO ACTIVATE
      : SYS"A:NEW
PJ 180 DATA169,0,160,0,36,116,
      80,6
CB 190 DATA32,30,171,76,0,0,32
      ,136
EE 200 DATA144,162,255,134,3,3
      2,207,255
SR 210 DATA36,116,80,6,32,19,1
      77,76
XH 220 DATA0,0,32,58,151,144,1
      2,166
DM 230 DATA3,232,224,8,176,3,1
      57,60
FA 240 DATA3,134,3,201,13,208,
      222,166
RH 250 DATA3,232,224,8,176,8,1
      69,0
FR 260 DATA157,60,3,76,0,0,169
      ,0
EH 270 DATA133,3,169,0,133,4,1
      69,0
SC 280 DATA133,5,170,160,0,152
      ,24,101
BG 290 DATA5,41,15,145,3,200,1
      92,16
CQ 300 DATA144,243,232,224,16,
      176,16,230
GK 310 DATA5,165,3,24,105,16,1
      33,3
AE 320 DATA144,2,230,4,76,0,0,
      165
FX 330 DATA43,24,105,4,133,5,1
      65,44
KB 340 DATA133,6,144,2,230,6,1
      69,0
CJ 350 DATA160,0,36,116,80,6,3
      2,30
CE 360 DATA171,76,0,0,32,136,1
      44,32
BS 370 DATA228,255,240,251,201
      ,68,208,2
PX 380 DATA240,120,201,67,208,
      241,169,0
AC 390 DATA141,96,3,169,0,141,
      97,3
EK 400 DATA32,0,0,32,0,0,240,3
      0
EM 410 DATA32,0,0,10,10,10,10,
      24
RS 420 DATA101,34,133,34,144,2
      ,230,35
QD 430 DATA32,0,0,24,101,4,145
      ,5
HE 440 DATA32,0,0,76,0,0,152,2
      4
GM 450 DATA105,5,101,5,133,5,1
      44,2
GR 460 DATA230,6,165,6,197,46,
      144,9
DP 470 DATA208,6,165,5,197,45,
      144,1
EB 480 DATA96,32,0,0,108,96,3,
      169
CQ 490 DATA0,133,3,160,0,166,3
      ,189
CS 500 DATA60,3,41,15,170,96,1
      69,0
FK 510 DATA133,34,169,0,133,35
      ,36,116
HX 520 DATA80,3,177,5,96,169,5
      ,76
CR 530 DATA148,4,169,0,141,96,
      3,169
BA 540 DATA0,141,97,3,32,0,0,3
      2
FK 550 DATA0,0,240,170,32,0,0,
      133
DB 560 DATA36,32,0,0,197,36,24
      0,15
SA 570 DATA165,34,24,105,16,13
      3,34,144
SA 580 DATA2,230,35,201,0,208,
      234,162
PJ 590 DATA0,32,0,0,24,101,4,1
      45
DH 600 DATA5,32,0,0,76,0,0,41
AH 610 DATA240,133,4,32,0,0,41
      ,15
EC 620 DATA96,230,3,165,3,41,7
      ,133
MH 630 DATA3,32,0,0,200,96,140
      ,80
CA 640 DATA3,138,168,36,116,80
      ,5,177
FF 650 DATA34,76,0,0,32,176,4,
      172
SD 660 DATA80,3,96,80,65,83,83
      ,87
EA 670 DATA79,82,68,63,32,0,13
      ,18
BK 680 DATA67,146,79,68,69,82,
      47,18
QG 690 DATA68,146,69,67,79,68,
      69,82,63,0
```

Poster Printer

Commodore 128, Plus/4, and 16 users see instructions in article on page 62 before typing in.

```
KC 10 REM COPYRIGHT 1987 COMPU
      TE! PUBLICATIONS, INC. -
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BM 20 IFPEEK(65530)=5THENBANK1
      5
DC 30 POKE56,59:POKE55,0:CLR:C
      H=15360:DIM B(8,8):OPEN4
      ,4,0:GOSUB740
MH 40 BH=5:BW=3:REM BANNER PIX
      EL HEIGHT (1-10) AND WID
      TH (1-)
XB 50 PW=1:REM SINGLE-PAGE PIX
      EL WIDTH (1-2)
XG 60 PRINT"{CLR}{3 SPACES}COP
      YRIGHT 1987 COMPUTE! PUB
      ., INC."
GH 70 PRINTTAB(11)"ALL RIGHTS
      {SPACE}RESERVED"
QG 80 PRINTTAB(11)"{5 DOWN}POS
      TER PRINTER"
XE 90 PRINTTAB(11)"{DOWN}1. BA
      NNER"
KK 100 PRINTTAB(11)"{DOWN}2. S
      INGLE PAGE"
SC 110 PRINTTAB(11)"{DOWN}3. F
      ORM FEED"
PQ 120 PRINTTAB(11)"{DOWN}4. E
      XIT PROGRAM"
XH 130 GETA$:IFA$<"1"ORA$>"4"T
      HEN130
RH 140 ONASC(A$)-48GOTO170,410
      ,150,160
FF 150 PRINT#4,CHR$(12):GOTO60
      :REM FORM FEED
DH 160 PRINT#4:CLOSE4:PRINT"
      {CLR}":END
SG 170 PRINT"{CLR}PLEASE ENTER
       THE MESSAGE TO";
BQ 180 A$="":PRINT" BE PRINTED
      ":INPUTA$:IFA$=""THEN60
QC 190 LP=LEN(A$)
GM 200 FORC=1TOLP:GOSUB210:NEX
      T:GOTO60
GH 210 X$=MID$(A$,C,1):SC=ASC(
      X$)
GJ 220 GOSUB330:CS=CH+SC*8
RC 230 FORI=0TO7:A(I)=PEEK(CS+
      I):NEXT
XK 240 FORBI=7TO0STEP-1
HQ 250 L1$=LEFT$("{36 SPACES}"
      ,(80-8*BH)/2)
XK 260 FORBY=7TO0STEP-1:IFA(BY
      )AND2↑BITHEN290
EG 270 L1$=L1$+LEFT$("
      {10 SPACES}",BH)
ED 280 GOTO300
HC 290 L1$=L1$+LEFT$("********
      **",BH)
DG 300 NEXTBY
MD 310 FORA=1TOBW:PRINT#4,L1$:
      NEXT
MP 320 NEXTBI:RETURN
CB 330 IFSC<32THENSC=128:RETUR
      N
XA 340 IFSC<64THENRETURN
RM 350 IFSC<96THENSC=SC-64:RET
      URN
RQ 360 IFSC<128THENSC=SC-32:RE
      TURN
JS 370 IFSC<160THENSC=128:RETU
      RN
SP 380 IFSC<192THENSC=SC-64:RE
      TURN
RJ 390 IFSC<255THENSC=SC-128:R
      ETURN
DF 400 SC=94:RETURN
PS 410 NC=8:IFPW=2THENNC=4
MK 420 PRINT"{CLR}{2 DOWN}ENTE
      R UP TO 5 LINES WITH"NC
      "LETTERS OR"
HC 430 PRINT"LESS PER LINE (CA
      RRIAGE RETURN TO QUIT)
      {DOWN}"
GE 440 FORA=1TO5:L1$="":PRINT"
      ENTER LINE";A:INPUTL1$
RK 450 IFA=1ANDL1$=""THENA=5:N
      EXT:GOTO60
GE 460 IFL1$=""THENA=5:NEXT:GO
      TO480
CF 470 L=A:L$(A)=LEFT$(L1$,NC)
      :NEXT
RG 480 W=12*L:W1=INT((60-W)/2)
      +5
BH 490 FORW=1TOW1:PRINT#4:NEXT
MQ 500 FORX=1TOL:GOSUB510:NEXT
      :GOTO60
RQ 510 LL=LEN(L$(X)):FORX1=1TO
```

```
      LL
SF 520 W$=MID$(L$(X),X1,1):SC=
       ASC(W$)
AA 530 GOSUB330
SX 540 CS=CH+SC*8
CK 550 FORX2=0TO7:B(X1,X2)=PEE
       K(CS+X2)
MJ 560 NEXTX2,X1
MF 570 LC=INT((80-(LL*PW*8+LL*
       2))/2):REM LL*2 FOR # S
       PACES BETWEEN ADJOINING
        CHARS
AX 580 PL$=""
CJ 590 IFLC=0THEN610
AX 600 FORX1=1TOLC:PL$=PL$+" "
       :NEXT
GG 610 SL$=PL$
FA 620 FORX2=0TO7:FORX1=1TOLL
BA 630 FORBI=7TO0STEP-1
KS 640 IFB(X1,X2)AND2↑BITHEN66
       0
FA 650 PL$=PL$+LEFT$("
       {2 SPACES}",PW):GOTO670
       :REM PIXEL WIDTH IN THI
       S LINE AND NEXT
JM 660 PL$=PL$+LEFT$("**",PW)
XG 670 NEXTBI
HM 680 PL$=PL$+"{2 SPACES}":RE
       M # SPACES BETWEEN ADJO
       INING CHARACTERS
XF 690 NEXTX1
PS 700 PRINT#4,PL$
FR 710 PL$=SL$
FG 720 NEXTX2
PF 730 FORA=1TO4:PRINT#4:NEXT:
       RETURN:REM SPACES BETWE
       EN TEXT LINES
JS 740 I=15104:REM LOCATE UPPE
       RCASE IN RAM
EP 750 READA:IFA=-1THENSYS1510
       4:RETURN
BA 760 POKEI,A:I=I+1:GOTO750
GC 770 REM 64 CHARACTER MOVE R
       OUTINE
FX 780 DATA 169,208,133,252,16
       9,60,133,254,169,0
SC 790 DATA 133,251,133,253,12
       0,165,1,41,251,133
QE 800 DATA 1,162,4,160,0,177,
       251,145,253,200
DP 810 DATA 208,249,230,252,23
       0,254,202,208,242,165
MJ 820 DATA 1,9,4,133,1,88,96,
       -1
```

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," elsewhere in this issue.

Subprograms For The 64

See instructions in article on page 68 before typing in.

Program 1: 64 Subprograms

```
0801:0C 08 01 00 9E 20 32 30 43
0809:36 32 00 00 00 A9 0A 85 01
0811:2C A9 00 8D 00 0A A9 22 18
0819:A0 08 8D 08 03 8C 09 03 0D
0821:60 20 73 00 C9 CB F0 0E 45
0829:C9 80 F0 0D C9 88 F0 0C 8B
0831:20 79 00 4C E7 A7 4C 43 2E
0839:08 4C E4 08 4C 11 09 00 36
0841:00 00 20 73 00 C9 22 F0 E8
0849:08 C6 7B 20 79 00 4C E7 CC
0851:A7 A0 00 20 73 00 C9 22 B0
0859:F0 07 99 3D 03 C8 4C 54 D2
0861:08 EA 8C 3C 03 A0 00 B9 D9
0869:2B 00 99 50 03 C0 17 F0 81
0871:04 C8 4C 68 08 A9 00 8D 3A
0879:00 C0 A0 00 B9 8B 08 99 73
0881:2B 00 C0 17 F0 1C C8 4C 86
0889:7D 08 01 C0 03 C0 03 C0 68
0891:03 C0 00 D0 00 D0 00 D0 74
0899:00 00 00 00 00 C0 00 00 AC
08A1:00 C0 A5 7A A4 7B 85 05 61
08A9:84 06 A9 FF 85 02 A9 02 3C
08B1:A2 08 A0 00 20 BA FF AD C2
08B9:3C 03 A2 3D A0 03 20 BD DF
08C1:FF A9 00 A2 01 A0 C0 20 92
08C9:D5 FF A5 AE A4 AF 85 2D 80
08D1:84 2E 85 2F 84 30 85 31 74
08D9:84 32 20 33 A5 20 8E A6 61
08E1:4C AE A7 A5 02 C9 FF D0 1B
08E9:21 A5 05 A4 06 85 7A 84 9E
08F1:7B A0 00 B9 50 03 99 2B 70
08F9:00 C0 17 F0 04 C8 4C F4 FC
0901:08 20 91 09 20 73 00 4C FC
0909:E7 A7 20 79 00 4C E7 A7 3D
0911:A5 02 C9 FF F0 06 20 79 09
0919:00 4C E7 A7 20 73 00 C9 4E
0921:2E F0 09 20 91 09 20 98 33
0929:09 4C 32 09 85 97 20 73 E7
0931:00 20 79 00 20 8B B0 A5 B0
0939:47 A4 48 85 03 84 04 A5 51
0941:02 C9 FF F0 06 20 91 09 B2
0949:20 98 09 20 79 00 C9 B2 C6
0951:D0 C4 A5 97 C9 2E F0 06 1A
0959:20 73 00 4C 67 09 E6 97 E1
0961:20 91 09 20 98 09 20 73 A7
0969:00 20 8B B0 A5 47 A4 48 DB
0971:20 A2 BB A5 03 A4 04 85 46
0979:49 84 4A 20 D0 BB A5 02 5F
0981:C9 FF F0 06 20 91 09 20 70
0989:98 09 20 79 00 4C E7 A7 6E
0991:A5 02 49 FF 85 02 60 A0 B5
0999:00 B9 2B 00 85 95 B9 50 C5
09A1:03 99 2B 00 A5 95 99 50 08
09A9:03 C0 17 F0 04 C8 4C 9A D5
09B1:09 60 00 00 00 00 00 00 60
```

Program 2: 64 Subprograms—BASIC Demo

```
KC 10 REM COPYRIGHT 1987 COMPU
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       ALL RIGHTS RESERVED
HE 20 PRINTCHR$(14)"{CLR}{BLK}
      {3 SPACES}COPYRIGHT 1987
       COMPUTE! PUB., INC."
RR 30 PRINTTAB(10)"ALL RIGHTS
      {SPACE}RESERVED"
RG 40 PRINT"{2 DOWN}THIS WILL
      {SPACE}DEMONSTRATE THE A
      BILITY OF{4 SPACES}SUBPR
      OGRAMS TO PASS ";
DS 50 PRINT"VARIABLES BETWEEN
      {3 SPACES}TWO PROGRAMS."
PJ 60 PRINT"{DOWN}WE WILL BEGI
      N BY ENTERING A NUMBER..
      .":INPUTA
CX 70 PRINT"{DOWN}WE WILL NOW
      {SPACE}CALL A SUBROUTINE
       TO{8 SPACES}MULTIPLY TH
      IS NUMBER BY 100."
GP 80 GOSUB170
RB 90 GO"SUB1"
AC 100 PRINT"{CLR}{2 DOWN}NOW
       {SPACE}THAT WE'RE BACK,
       LET'S DISPLAY THE
       {2 SPACES}RESULT."
DM 110 PRINT"{DOWN}YOUR NUMBER
       * 100 ="A"{LEFT}.":PRI
       NT:GOSUB170
EC 120 PRINT"{2 DOWN}NOW LET'S
       TAKE SEVERAL NUMBERS,
       {SPACE}AND{5 SPACES}AVE
       RAGE THEM OUT WITH THE"
       ;
AS 130 PRINT" VARIABLE JUST":P
       RINT"RETURNED.":INPUTB,
       C,D,E
HK 140 PRINT"{DOWN}WE WILL NOW
        CALL THE NEXT SUBROUTI
       NE...":GO"SUB2"
AG 150 PRINT"{DOWN}THE ANSWER
       {SPACE}TO OUR PROBLEM I
       S"A"{LEFT}."
MX 160 END
PQ 170 FORI=0TO2500:NEXT:RETUR
       N
```

Program 3: 64 Subprograms—Subprogram 1

```
BQ 10 PRINT"{CLR}{2 DOWN}WE AR
      E NOW IN THE SUBROUTINE
      {SPACE}THAT WILL
      {2 SPACES}MULTIPLY OUR N
      UMBER."
AD 20 PRINT"{DOWN}WE WILL CLEA
      R VARIABLES TO SHOW THE
      {SPACE}MAINPROGRAM WILL
      {SPACE}NOT BE ";
GB 30 PRINT"AFFECTED.":CLR
BK 40 PRINT"{DOWN}FIRST, WE MU
      ST PASS THE VARIABLE."
HE 50 LET.A=A: REM ASSIGN LOCA
      L 'A' THE VALUE OF THE M
      AIN PROGRAM 'A'
FC 60 B=A*100:REM 'LET' NOT RE
      QUIRED HERE
MF 70 LETA=.B: REM SEND THE VA
      LUE BACK TO THE MAIN PRO
      GRAM
HK 80 PRINT"{DOWN}AFTER YOU HI
      T ANY KEY, WE WILL RETUR
      N TOTHE MAIN PROGRAM."
SH 90 GETZ$:IFZ$=""THEN90
CP 100 END
```

Program 4: 64 Subprograms—Subprogram 2

```
XA 10 PRINT"{CLR}{2 DOWN}WE AR
      E NOW IN THE SECOND ROUT
      INE. HERE{2 SPACES}WE WI
      LL AVERAGE OUT THE ";
PA 20 PRINT"NUMBERS THAT
      {4 SPACES}WERE INPUT, IN
      CLUDING THE FIRST NUMBER
      "
CP 30 PRINT"WE MULTIPLIED.":PR
      INT"{DOWN}AGAIN, LET'S C
      LEAR VARIABLES.":CLR
RC 40 PRINT"{DOWN}NOW TO GET T
      HE VALUES..."
BQ 50 LET.A=A:LET.B=B:LET.C=C:
      LET.D=D:LET.E=E
EK 60 AN=(A+B+C+D+E)/5:REM SIN
      CE THIS IS A LOCAL FUNCT
      ION, 'LET' IS NOT USED
RG 70 LETA=.AN: REM SEND VALUE
       BACK TO THE MAIN PROGRA
      M
FG 80 PRINT"{DOWN}HIT ANY KEY
      {SPACE}TO GO BACK."
SH 90 GETZ$:IFZ$=""THEN90
CP 100 END
```

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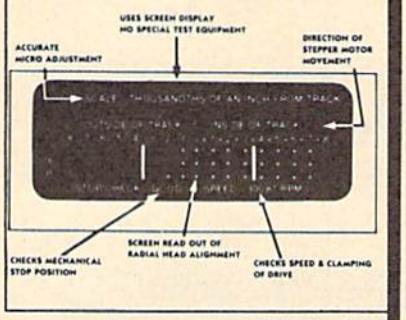
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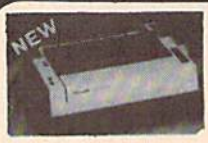

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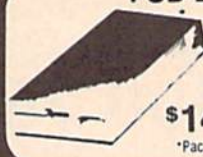

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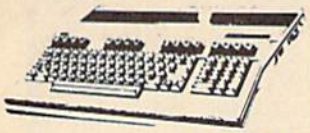

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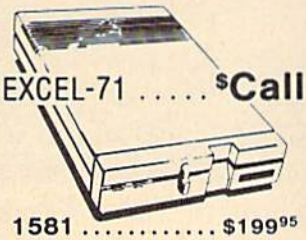

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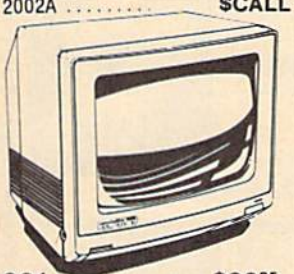

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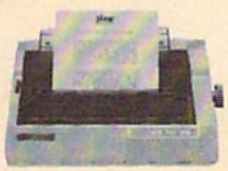

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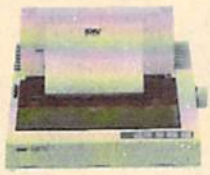

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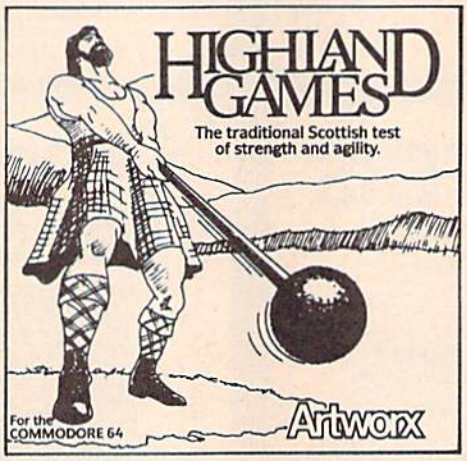

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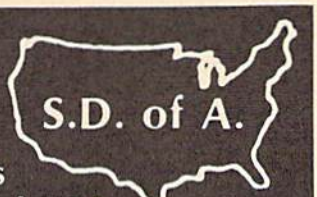

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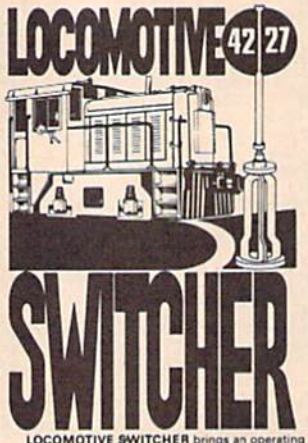

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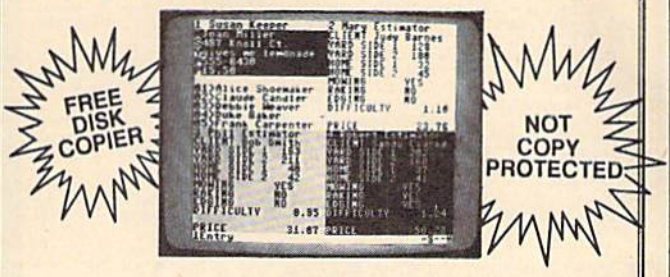

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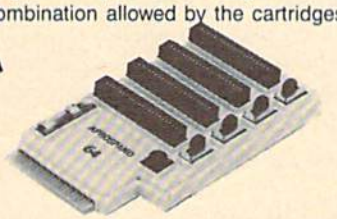

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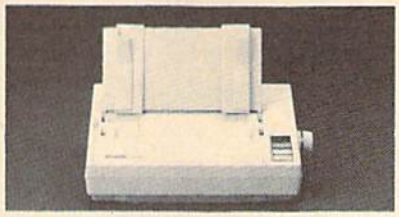

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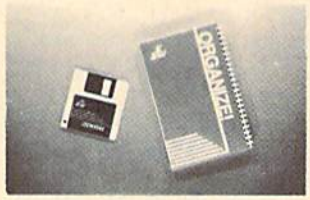

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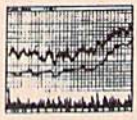

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How To Type In *COMPUTE!'s Gazette* Programs

Each month, COMPUTE!'s Gazette publishes programs for the Commodore 128, 64, Plus/4, and 16. Each program is clearly marked by title and version. Be sure to type in the correct version for your machine. All 64 programs run on the 128 in 64 mode. Be sure to read the instructions in the corresponding article. This can save time and eliminate any questions which might arise after you begin typing.

We frequently publish two programs designed to make typing easier: The Automatic Proofreader, and MLX, designed for entering machine language programs.

When entering a BASIC program, be especially careful with DATA statements as they are extremely sensitive to errors. A mistyped number in a DATA statement can cause your machine to "lock up" (you'll have no control over the computer). If this happens, the only recourse is to turn your computer off then on, erasing what was in memory. So be sure to *save a program before you run it.* If your computer crashes, you can always reload the program and look for the error.

Special Characters

Most of the programs listed in each issue contain special control characters. To facilitate typing in any programs from the GAZETTE, use the following listing conventions.

The most common type of control characters in our listings appear as words within braces: {DOWN} means to press the cursor down key; {5 SPACES} means to press the space bar five times.

To indicate that a key should be *shifted* (hold down the SHIFT key while pressing another key), the character is underlined. For example, A means hold down the SHIFT key and press A. You may see strange characters on your screen, but that's to be expected. If you find a number followed by an underlined key enclosed in braces (for example, {8 A}), type the key as many times as indicated (in our example, enter eight SHIFTed A's).

If a key is enclosed in special brackets, [ ], hold down the Commodore key (at the lower left corner of the keyboard) and press the indicated character.

Rarely, you'll see a single letter of the alphabet enclosed in braces. This can be entered on the Commodore 64 by pressing the CTRL key while typing the letter in braces. For example, {A} means to press CTRL-A.

The Quote Mode

Although you can move the cursor around the screen with the CRSR keys, often a programmer will want to move the cursor under program control. This is seen in examples such as {LEFT}, and {HOME} in the program listings. The only way the computer can tell the difference between direct and programmed cursor control is *the quote mode.*

Once you press the quote key, you're in quote mode. This mode can be confusing if you mistype a character and cursor left to change it. You'll see a reverse video character (a graphics symbol for cursor left). In this case, you can use the DELete key to back up and edit the line. Type another quote and you're out of quote mode. If things really get confusing, you can exit quote mode simply by pressing RETURN. Then just cursor up to the mistyped line and fix it.

When You Read:	Press:	See:
{CLR}	SHIFT + CLR/HOME	
{HOME}	CLR/HOME	
{UP}	SHIFT + ↑ CRSR ↓	
{DOWN}	↑ CRSR ↓	
{LEFT}	SHIFT + ← CRSR →	
{RIGHT}	← CRSR →	
{RVS}	CTRL + 9	
{OFF}	CTRL + 0	
{BLK}	CTRL + 1	
{WHT}	CTRL + 2	
{RED}	CTRL + 3	
{CYN}	CTRL + 4	

When You Read:	Press:	See:
{PUR}	CTRL + 5	
{GRN}	CTRL + 6	
{BLU}	CTRL + 7	
{YEL}	CTRL + 8	
{ F1 }	f1	
{ F2 }	SHIFT + f1	
{ F3 }	f3	
{ F4 }	SHIFT + f3	
{ F5 }	f5	
{ F6 }	SHIFT + f5	
{ F7 }	f7	
{ F8 }	SHIFT + f7	

When You Read:	Press:	See:
←	←	
↑	SHIFT + ↑	

For Commodore 64 Only

[1]	COMMODORE + 1	
[2]	COMMODORE + 2	
[3]	COMMODORE + 3	
[4]	COMMODORE + 4	
[5]	COMMODORE + 5	
[6]	COMMODORE + 6	
[7]	COMMODORE + 7	
[8]	COMMODORE + 8	

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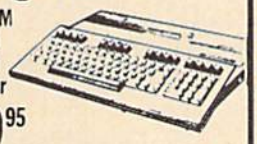

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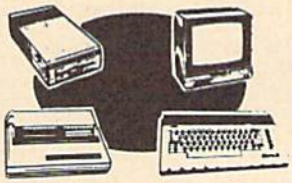

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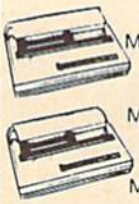

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The Automatic Proofreader

Philip I. Nelson

"The Automatic Proofreader" helps you type in program listings for the 128, 64, Plus/4, and 16 and prevents nearly every kind of typing mistake.

Type in the Proofreader *exactly* as listed. Since the program can't check itself, type carefully to avoid mistakes. Don't omit any lines, even if they contain unfamiliar commands. After finishing, save a copy or two on disk or tape before running it. This is important because the Proofreader erases the BASIC portion of itself when you run it, leaving only the machine language portion in memory.

Next, type RUN and press RETURN. After announcing which computer it's running on, the Proofreader displays the message "Proofreader Active". Now you're ready to type in a BASIC program.

Every time you finish typing a line and press RETURN, the Proofreader displays a two-letter checksum in the upper-left corner of the screen. Compare this result with the two-letter checksum printed to the left of the line in the program listing. If the letters match, it's almost certain the line was typed correctly. If the letters don't match, check for your mistake and correct the line.

The Proofreader ignores spaces not enclosed in quotes, so you can omit or add spaces between keywords and still see a matching checksum. However, since spaces inside quotes are almost always significant, the Proofreader pays attention to them. For example, **10 PRINT"THIS IS BASIC"** will generate a different checksum than **10 PRINT"THIS ISBA SIC"**.

A common typing error is transposition—typing two successive characters in the wrong order, like PIRNT instead of PRINT or 64378 instead of 64738. The Proofreader is sensitive to the *position* of each character within the line and thus catches transposition errors.

The Proofreader does *not* accept keyword abbreviations (for example, ? instead of PRINT). If you prefer to use abbreviations, you can still check the line by LISTing it after typing it in, moving the cursor back to the line, and pressing RETURN. LISTing the line substitutes the full keyword for the abbreviation and allows the Proofreader to work properly. The same technique works for rechecking programs you've already typed in.

If you're using the Proofreader on the Commodore 128, Plus/4, or 16, *do not perform any GRAPHIC commands while the Proofreader is active.* When you perform a command like GRAPHIC 1, the computer moves everything at the start of BASIC program space—including the Proofreader—to another memory area, causing the Proofreader to crash. The same thing happens if you *run* any program with a GRAPHIC command while the Proofreader is in memory.

Though the Proofreader doesn't interfere with other BASIC operations, it's a good idea to disable it before running another program. However, the Proofreader is purposely difficult to dislodge: It's not affected by tape or disk operations, or by pressing RUN/STOP- RESTORE. The simplest way to disable it is to turn the computer off then on. A gentler method is to SYS to the computer's built-in reset routine (SYS 65341 for the 128, 64738 for the 64, and 65526 for the Plus/4 and 16). These reset routines erase any program in memory, so be sure to save the program you're typing in before entering the SYS command.

If you own a Commodore 64, you may already have wondered whether the Proofreader works with other programming utilities like "MetaBASIC." The answer is generally yes, *if you're using a 64 and activate the Proofreader after installing the other utility.* For example, first load and activate MetaBASIC, then load and run the Proofreader.

When using the Proofreader with another utility, you should disable *both* programs before running a BASIC program. While the Proofreader seems unaffected by most utilities, there's no way to promise that it will work with any and every combination of utilities you might want to use. The more utilities activated, the more fragile the system becomes.

The New Automatic Proofreader

```
10 VEC=PEEK(772)+256*PEEK(773)
   :LO=43:HI=44
20 PRINT "AUTOMATIC PROOFREADE
   R FOR ";:IF VEC=42364 THEN
   {SPACE}PRINT "C-64"
30 IF VEC=50556 THEN PRINT "VI
   C-20"
40 IF VEC=35158 THEN GRAPHIC C
   LR:PRINT "PLUS/4 & 16"
50 IF VEC=17165 THEN LO=45:HI=
   46:GRAPHIC CLR:PRINT"128"
60 SA=(PEEK(LO)+256*PEEK(HI))+
   6:ADR=SA
70 FOR J=0 TO 166:READ BYT:POK
   E ADR,BYT:ADR=ADR+1:CHK=CHK
   +BYT:NEXT
80 IF CHK<>20570 THEN PRINT "*
   ERROR* CHECK TYPING IN DATA
    STATEMENTS":END
90 FOR J=1 TO 5:READ RF,LF,HF:
   RS=SA+RF:HB=INT(RS/256):LB=
   RS-(256*HB)
100 CHK=CHK+RF+LF+HF:POKE SA+L
   F,LB:POKE SA+HF,HB:NEXT
110 IF CHK<>22054 THEN PRINT "
   *ERROR* RELOAD PROGRAM AND
   {SPACE}CHECK FINAL LINE":EN
   D
120 POKE SA+149,PEEK(772):POKE
    SA+150,PEEK(773)
130 IF VEC=17165 THEN POKE SA+
   14,22:POKE SA+18,23:POKESA+
   29,224:POKESA+139,224
140 PRINT CHR$(147);CHR$(17);"
   PROOFREADER ACTIVE":SYS SA
150 POKE HI,PEEK(HI)+1:POKE (P
   EEK(LO)+256*PEEK(HI))-1,0:N
   EW
160 DATA 120,169,73,141,4,3,16
   9,3,141,5,3
170 DATA 88,96,165,20,133,167,
   165,21,133,168,169
180 DATA 0,141,0,255,162,31,18
   1,199,157,227,3
190 DATA 202,16,248,169,19,32,
   210,255,169,18,32
200 DATA 210,255,160,0,132,180
   ,132,176,136,230,180
210 DATA 200,185,0,2,240,46,20
   1,34,208,8,72
220 DATA 165,176,73,255,133,17
   6,104,72,201,32,208
230 DATA 7,165,176,208,3,104,2
   08,226,104,166,180
240 DATA 24,165,167,121,0,2,13
   3,167,165,168,105
250 DATA 0,133,168,202,208,239
   ,240,202,165,167,69
260 DATA 168,72,41,15,168,185,
   211,3,32,210,255
270 DATA 104,74,74,74,74,168,1
   85,211,3,32,210
280 DATA 255,162,31,189,227,3,
   149,199,202,16,248
290 DATA 169,146,32,210,255,76
   ,86,137,65,66,67
300 DATA 68,69,70,71,72,74,75,
   77,80,81,82,83,88
310 DATA 13,2,7,167,31,32,151,
   116,117,151,128,129,167,136
   ,137
```

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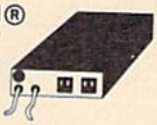

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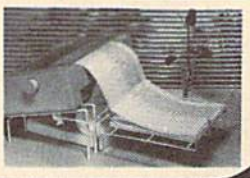

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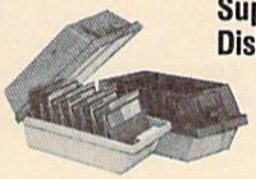

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MLX Machine Language Entry Program For Commodore 64 and 128

Ottis R. Cowper, Technical Editor

"MLX" is a labor-saving utility that allows almost fail-safe entry of machine language programs. Included are versions for the Commodore 64 and 128.

Type in and save some copies of whichever version of MLX is appropriate for your computer (you'll want to use it to enter future ML programs from COMPUTE!'s GAZETTE). Program 1 is for the Commodore 64, and Program 2 is for the 128 (128 MLX can also be used to enter Commodore 64 ML programs for use in 64 mode). When you're ready to enter an ML program, load and run MLX. It asks you for a starting address and an ending address. These addresses appear in the article accompanying the MLX-format program listing you're typing.

If you're unfamiliar with machine language, the addresses (and all other values you enter in MLX) may appear strange. Instead of the usual decimal numbers you're accustomed to, these numbers are in *hexadecimal*—a base 16 numbering system commonly used by ML programmers. Hexadecimal—hex for short—includes the numerals 0–9 and the letters A–F. But don't worry—even if you know nothing about ML or hex, you should have no trouble using MLX.

After you enter the starting and ending addresses, you'll be offered the option of clearing the workspace. Choose this option if you're starting to enter a new listing. If you're continuing a listing that's partially typed from a previous session, don't choose this option.

A functions menu will appear. The first option in the menu is ENTER DATA. If you're just starting to type in a program, pick this. Press the E key, and type the first number in the first line of the program listing. If you've already typed in part of a program, type the line number where you left off typing at the end of the previous session (be sure to load the partially completed program before you resume entry). In any case, make sure the address you enter corresponds to the address of a line in the listing you are entering. Otherwise, you'll be unable to enter the data correctly. If you pressed E by mistake, you can return to the command menu by pressing RETURN alone when asked for the address. (You can get back to the menu from most options by pressing RETURN with no other input.)

Entering A Listing

Once you're in Enter mode, MLX prints the address for each program line for you. You then type in all nine numbers on that line, beginning with the first two-digit number after the colon (:). Each line represents eight data bytes and a checksum. Although an MLX-format listing appears similar to the "hex dump" listings from a machine language monitor program, the extra checksum number on the end allows MLX to check your typing. (Commodore 128 users *can* enter the data from an MLX listing using the built-in monitor if the rightmost column of data is omitted, but we recommend against it. It's much easier to let MLX do the proofreading and error checking for you.)

When you enter a line, MLX recalculates the checksum from the eight bytes and the address and compares this value to the number from the ninth column. If the values match, you'll hear a bell tone, the data will be added to the workspace area, and the prompt for the next line of data will appear. But if MLX detects a typing error, you'll hear a low buzz and see an error message. The line will then be redisplayed for editing.

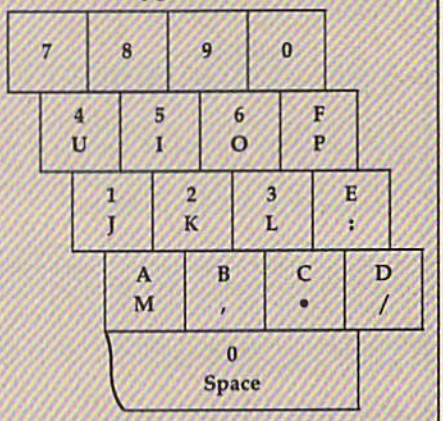
Invalid Characters Banned

Only a few keys are active while you're entering data, so you may have to unlearn some habits. You *do not* type spaces between the columns; MLX automatically inserts these for you. You *do not* press RETURN after typing the last number in a line; MLX automatically enters and checks the line after you type the last digit.

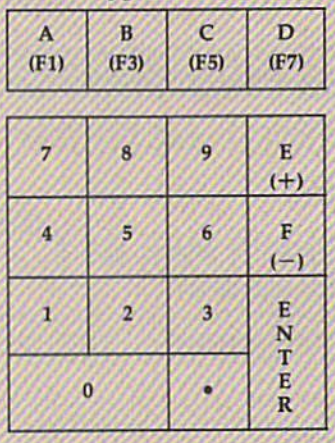
Only the numerals 0–9 and the letters A–F can be typed in. If you press any other key (with some exceptions noted below), you'll hear a warning buzz. To simplify typing, 128 MLX redefines the function keys and + and − keys on the numeric keypad so that you can enter data one-handed. (The 64 version incorporates the keypad modification from the March 1986 "Bug-Swatter" column, lines 485–487.) In either case, the keypad is active only while entering data. Addresses must be entered with the normal letter and number keys. The figures above show the keypad configurations for each version.

MLX checks for transposed characters. If you're supposed to type in A0 and instead enter 0A, MLX will catch your mistake. There is one error that can slip past MLX: Because of the checksum formula used, MLX won't notice if you accidentally type FF in place of 00, and vice versa. And there's a very slim chance that you could garble a line and still end up with a combination of characters that adds up to the proper checksum. However, these mistakes should not occur if you take reasonable care while entering data.

64 MLX Keypad



128 MLX Keypad



Editing Features

To correct typing mistakes before finishing a line, use the INST/DEL key to delete the character to the left of the cursor. (The cursor-left key also deletes.) If you mess up a line really badly, press CLR/HOME to start the line over. The RETURN key is also active, but only before any data is typed on a line. Pressing RETURN at this point returns you to the command menu. After you type a character of data, MLX disables RETURN until the cursor returns to the start of a line. Remember, you can press CLR/HOME to quickly get to a line

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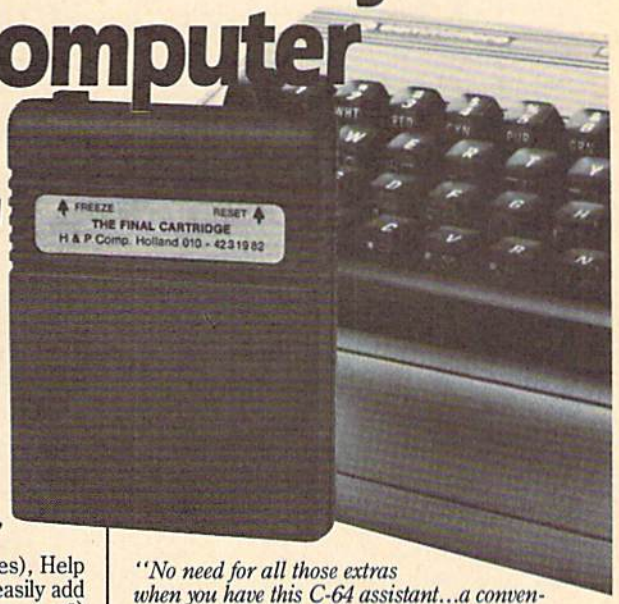

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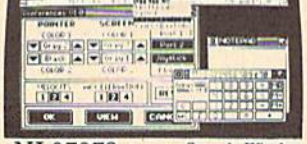
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number prompt.

More editing features are available when correcting lines in which MLX has detected an error. To make corrections in a line that MLX has redisplayed for editing, compare the line on the screen with the one printed in the listing, then move the cursor to the mistake and type the correct key. The cursor left and right keys provide the normal cursor controls. (The INST/DEL key now works as an alternative cursor-left key.) You cannot move left beyond the first character in the line. If you try to move beyond the rightmost character, you'll reenter the line. During editing, RETURN is active; pressing it tells MLX to recheck the line. You can press the CLR/HOME key to clear the entire line if you want to start from scratch, or if you want to get to a line number prompt to use RETURN to get back to the menu.

Display Data

The second menu choice, DISPLAY DATA, examines memory and shows the contents in the same format as the program listing (including the checksum). When you press D, MLX asks you for a starting address. Be sure that the starting address you give corresponds to a line number in the listing. Otherwise, the checksum display will be meaningless. MLX displays program lines until it reaches the end of the program, at which point the menu is redisplayed. You can pause the display by pressing the space bar. (MLX finishes printing the current line before halting.) Press space again to restart the display. To break out of the display and get back to the menu before the ending address is reached, press RETURN.

Other Menu Options

Two more menu selections let you save programs and load them back into the computer. These are SAVE FILE and LOAD FILE; their operation is quite straightforward. When you press S or L, MLX asks you for the filename. You'll then be asked to press either D or T to select disk or tape.

You'll notice the disk drive starting and stopping several times during a load or save (save only for the 128 version). Don't panic; this is normal behavior. MLX opens and reads from or writes to the file instead of using the usual LOAD and SAVE commands (128 MLX makes use of BLOAD). Disk users should also note that the drive prefix 0: is automatically added to the filename (line 750 in 64 MLX), so this should *not* be included when entering the name. This also precludes the use of @ for Save-with-Replace, so remember to give each version you save a different name. The 128 version makes up for this by giving you the option of scratching the existing file if you want to reuse a filename.

Remember that MLX saves the entire workspace area from the starting address to the ending address, so the save or load may take longer than you might expect if you've entered only a small amount of data from a long listing. When saving a partially completed listing, make sure to note the address where you stopped typing so you'll know where to resume entry when you reload.

MLX reports the standard disk or tape error messages if any problems are detected during the save or load. (Tape users should bear in mind that Commodore computers are never able to detect errors during a save to tape.) MLX also has three special load error messages: INCORRECT STARTING ADDRESS, which means the file you're trying to load does not have the starting address you specified when you ran MLX; LOAD ENDED AT *address*, which means the file you're trying to load ends before the ending address you specified when you started MLX; and TRUNCATED AT ENDING ADDRESS, which means the file you're trying to load extends beyond the ending address you specified when you started MLX. If you see one of these messages and feel certain that you've loaded the right file, exit and rerun MLX, being careful to enter the correct starting and ending addresses.

The 128 version also has a CATALOG DISK option so you can view the contents of the disk directory before saving or loading.

The QUIT menu option has the obvious effect—it stops MLX and enters BASIC. The RUN/STOP key is disabled, so the Q option lets you exit the program without turning off the computer. (Of course, RUN/STOP–RESTORE also gets you out.) You'll be asked for verification; press Y to exit to BASIC, or any other key to return to the menu. After quitting, you can type RUN again and reenter MLX without losing your data, as long as you don't use the clear workspace option.

The Finished Product

When you've finished typing all the data for an ML program and saved your work, you're ready to see the results. The instructions for loading and using the finished product vary from program to program. Some ML programs are designed to be loaded and run like BASIC programs, so all you need to type is LOAD *"filename"*,8 for disk (DLOAD *"filename"* on the 128) or LOAD *"filename"* for tape, and then RUN. Such programs will usually have a starting address of 0801 for the 64 or 1C01 for the 128. Other programs must be reloaded to specific addresses with a command such as LOAD *"filename"*,8,1 for disk (BLOAD *"filename"* on the 128) or LOAD *"filename"*,1,1 for tape, then started with a SYS to a particular memory address. On the Commodore 64, the most common starting address for such programs is 49152, which corresponds to MLX address C000. In either case, you should always refer to the article which accompanies the ML listing for information on loading and running the program.

An Ounce Of Prevention

By the time you finish typing in the data for a long ML program, you may have several hours invested in the project. Don't take chances—use our "Automatic Proofreader" to type the new MLX, and then test your copy *thoroughly* before first using it to enter any significant amount of data. Make sure all the menu options work as they should. Enter fragments of the program starting at several different addresses, then use the Display option to verify that the data has been entered correctly. And be sure to test the Save and Load options several times to ensure that you can recall your work from disk or tape. Don't let a simple typing error in the new MLX cost you several nights of hard work.

Program 1: MLX For Commodore 64

```
SS 10 REM VERSION 1.1: LINES 8
      30,950 MODIFIED, LINES 4
      85-487 ADDED
EK 100 POKE 56,50:CLR:DIM IN$,
       I,J,A,B,A$,B$,A(7),N$
DM 110 C4=48:C6=16:C7=7:Z2=2:Z
       4=254:Z5=255:Z6=256:Z7=
       127
CJ 120 FA=PEEK(45)+Z6*PEEK(46)
       :BS=PEEK(55)+Z6*PEEK(56
       ):H$="0123456789ABCDEF"
SB 130 R$=CHR$(13):L$="{LEFT}"
       :S$=" ":D$=CHR$(20):Z$=
       CHR$(0):T$="{13 RIGHT}"
CQ 140 SD=54272:FOR I=SD TO SD
       +23:POKE I,0:NEXT:POKE
       {SPACE}SD+24,15:POKE 78
       8,52
FC 150 PRINT"{CLR}"CHR$(142)CH
       R$(8):POKE 53280,15:POK
       E 53281,15
EJ 160 PRINT T$" {RED}{RVS}
       {2 SPACES}{8 @}
       {2 SPACES}"SPC(28)"
       {2 SPACES}{OFF}{BLU} ML
       X II {RED}{RVS}
       {2 SPACES}"SPC(28)"
       {12 SPACES}{BLU}"
FR 170 PRINT"{3 DOWN}
       {3 SPACES}COMPUTE!'S MA
       CHINE LANGUAGE EDITOR
       {3 DOWN}"
JB 180 PRINT"{BLK}STARTING ADD
```

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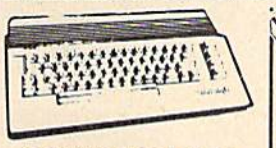

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```
      RESS[4]";:GOSUB300:SA=AD:GOSUB1040:IF F THEN180
GF 190 PRINT"{BLK}{2 SPACES}ENDING ADDRESS[4]";:GOSUB300:EA=AD:GOSUB1030:IF {SPACE}F THEN190
KR 200 INPUT"{3 DOWN}{BLK}CLEAR WORKSPACE [Y/N][4]";A$:IF LEFT$(A$,1)<>"Y"THEN220
PG 210 PRINT"{2 DOWN}{BLU}WORKING...";:FORI=BS TO BS+EA-SA+7:POKE I,0:NEXT:PRINT"DONE"
DR 220 PRINTTAB(10)"{2 DOWN}{BLK}{RVS} MLX COMMAND {SPACE}MENU {DOWN}[4]":PRINT T$"{RVS}E{OFF}NTER DATA"
BD 230 PRINT T$"{RVS}D{OFF}ISPLAY DATA":PRINT T$"{RVS}L{OFF}OAD FILE"
JS 240 PRINT T$"{RVS}S{OFF}AVE FILE":PRINT T$"{RVS}Q{OFF}UIT{2 DOWN}{BLK}"
JH 250 GET A$:IF A$=N$ THEN250
HK 260 A=0:FOR I=1 TO 5:IF A$=MID$("EDLSQ",I,1)THEN A=I:I=5
FD 270 NEXT:ON A GOTO420,610,690,700,280:GOSUB1060:GOTO250
EJ 280 PRINT"{RVS} QUIT ":INPUT"{DOWN}[4]ARE YOU SURE [Y/N]";A$:IF LEFT$(A$,1)<>"Y"THEN220
EM 290 POKE SD+24,0:END
JX 300 IN$=N$:AD=0:INPUTIN$:IF LEN(IN$)<>4THENRETURN
KF 310 B$=IN$:GOSUB320:AD=A:B$=MID$(IN$,3):GOSUB320:AD=AD*256+A:RETURN
PP 320 A=0:FOR J=1 TO 2:A$=MID$(B$,J,1):B=ASC(A$)-C4+(A$>"@")*C7:A=A*C6+B
JA 330 IF B<0 OR B>15 THEN AD=0:A=-1:J=2
GX 340 NEXT:RETURN
CH 350 B=INT(A/C6):PRINT MID$(H$,B+1,1);:B=A-B*C6:PRINT MID$(H$,B+1,1);:RETURN
RR 360 A=INT(AD/Z6):GOSUB350:A=AD-A*Z6:GOSUB350:PRINT":";
BE 370 CK=INT(AD/Z6):CK=AD-Z4*CK+Z5*(CK>Z7):GOTO390
PX 380 CK=CK*Z2+Z5*(CK>Z7)+A
JC 390 CK=CK+Z5*(CK>Z5):RETURN
QS 400 PRINT"{DOWN}STARTING AT [4]";:GOSUB300:IF IN$<>N$ THEN GOSUB1030:IF F {SPACE}THEN400
EX 410 RETURN
HD 420 PRINT"{RVS} ENTER DATA {SPACE}":GOSUB400:IF IN$=N$ THEN220
JK 430 OPEN3,3:PRINT
SK 440 POKE198,0:GOSUB360:IF F THEN PRINT IN$:PRINT"{UP}{5 RIGHT}";
GC 450 FOR I=0 TO 24 STEP 3:B$=S$:FOR J=1 TO 2:IF F THEN B$=MID$(IN$,I+J,1)
HA 460 PRINT"{RVS}"B$L$;:IF I<24THEN PRINT"{OFF}";
HD 470 GET A$:IF A$=N$ THEN470
FK 480 IF(A$>"/"ANDA$<":")OR(A$>"@"ANDA$<"G")THEN540
GS 485 A=-(A$="M")-2*(A$=",")-3*(A$=".")-4*(A$="/")-5*(A$="J")-6*(A$="K")
FX 486 A=A-7*(A$="L")-8*(A$=":")-9*(A$="U")-10*(A$="I")-11*(A$="O")-12*(A$="P")
CM 487 A=A-13*(A$=S$):IF A THEN A$=MID$("ABCD123E456F0",A,1):GOTO 540
MP 490 IF A$=R$ AND((I=0)AND(J=1)OR F)THEN PRINT B$;:J=2:NEXT:I=24:GOTO550
KC 500 IF A$="{HOME}" THEN PRINT B$:J=2:NEXT:I=24:NEXT:F=0:GOTO440
MX 510 IF(A$="{RIGHT}")ANDF THENPRINT B$L$;:GOTO540
GK 520 IF A$<>L$ AND A$<>D$ OR((I=0)AND(J=1))THEN GOSUB1060:GOTO470
HG 530 A$=L$+S$+L$:PRINT B$L$;:J=2-J:IF J THEN PRINT {SPACE}L$;:I=I-3
QS 540 PRINT A$;:NEXT J:PRINT {SPACE}S$;
PM 550 NEXT I:PRINT:PRINT"{UP}{5 RIGHT}";:INPUT#3,IN$:IF IN$=N$ THEN CLOSE3:GOTO220
QC 560 FOR I=1 TO 25 STEP3:B$=MID$(IN$,I):GOSUB320:IF I<25 THEN GOSUB380:A(I/3)=A
PK 570 NEXT:IF A<>CK THEN GOSUB1060:PRINT"{BLK}{RVS} {SPACE}ERROR: REENTER LINE [4]":F=1:GOTO440
HJ 580 GOSUB1080:B=BS+AD-SA:FOR I=0 TO 7:POKE B+I,A(I):NEXT
QQ 590 AD=AD+8:IF AD>EA THEN CLOSE3:PRINT"{DOWN}{BLU}** END OF ENTRY **{BLK}{2 DOWN}":GOTO700
GQ 600 F=0:GOTO440
QA 610 PRINT"{CLR}{DOWN}{RVS} {SPACE}DISPLAY DATA ":GOSUB400:IF IN$=N$ THEN220
RJ 620 PRINT"{DOWN}{BLU}PRESS: {RVS}SPACE{OFF} TO PAUSE, {RVS}RETURN{OFF} TO BREAK[4]{DOWN}"
KS 630 GOSUB360:B=BS+AD-SA:FOR I=BTO B+7:A=PEEK(I):GOSUB350:GOSUB380:PRINT S$;
CC 640 NEXT:PRINT"{RVS}";:A=CK:GOSUB350:PRINT
KH 650 F=1:AD=AD+8:IF AD>EA THENPRINT"{DOWN}{BLU}** END OF DATA **":GOTO220
KC 660 GET A$:IF A$=R$ THEN GOSUB1080:GOTO220
EQ 670 IF A$=S$ THEN F=F+1:GOSUB1080
AD 680 ONFGOTO630,660,630
CM 690 PRINT"{DOWN}{RVS} LOAD {SPACE}DATA ":OP=1:GOTO710
PC 700 PRINT"{DOWN}{RVS} SAVE {SPACE}FILE ":OP=0
RX 710 IN$=N$:INPUT"{DOWN}FILENAME[4]";IN$:IF IN$=N$ {SPACE}THEN220
PR 720 F=0:PRINT"{DOWN}{BLK} {RVS}T{OFF}APE OR {RVS}D{OFF}ISK: [4]";
FP 730 GET A$:IF A$="T"THEN PRINT"T{DOWN}":GOTO880
HQ 740 IF A$<>"D"THEN730
HH 750 PRINT"D{DOWN}":OPEN15,8,15,"I0:":B=EA-SA:IN$=" 0:"+IN$:IF OP THEN810
SQ 760 OPEN 1,8,8,IN$+",P,W":GOSUB860:IF A THEN220
FJ 770 AH=INT(SA/256):AL=SA-(AH*256):PRINT#1,CHR$(AL);CHR$(AH);
PE 780 FOR I=0 TO B:PRINT#1,CHR$(PEEK(BS+I));:IF ST THEN800
FC 790 NEXT:CLOSE1:CLOSE15:GOTO940
GS 800 GOSUB1060:PRINT"{DOWN}{BLK}ERROR DURING SAVE:[4]":GOSUB860:GOTO220
MA 810 OPEN 1,8,8,IN$+",P,R":GOSUB860:IF A THEN220
GE 820 GET#1,A$,B$:AD=ASC(A$+Z$)+256*ASC(B$+Z$):IF AD<>SA THEN F=1:GOTO850
RX 830 FOR I=0 TO B:GET#1,A$:POKE BS+I,ASC(A$+Z$):IF(I<>B)AND ST THEN F=2:AD=I:I=B
FA 840 NEXT:IF ST<>64 THEN F=3
FQ 850 CLOSE1:CLOSE15:ON ABS(F>0)+1 GOTO960,970
SA 860 INPUT#15,A,A$:IF A THEN CLOSE1:CLOSE15:GOSUB1060:PRINT"{RVS}ERROR: "A$
GQ 870 RETURN
EJ 880 POKE183,PEEK(FA+2):POKE187,PEEK(FA+3):POKE188,PEEK(FA+4):IFOP=0THEN920
HJ 890 SYS 63466:IF(PEEK(783)AND1)THEN GOSUB1060:PRINT"{DOWN}{RVS} FILE NOT {SPACE}FOUND ":GOTO690
CS 900 AD=PEEK(829)+256*PEEK(830):IF AD<>SA THEN F=1:GOTO970
SC 910 A=PEEK(831)+256*PEEK(832)-1:F=F-2*(A<EA)-3*(A>EA):AD=A-AD:GOTO930
KM 920 A=SA:B=EA+1:GOSUB1010:POKE780,3:SYS 63338
JF 930 A=BS:B=BS+(EA-SA)+1:GOSUB1010:ON OP GOTO950:SYS 63591
AE 940 GOSUB1080:PRINT"{BLU}** SAVE COMPLETED **":GOTO220
XP 950 POKE147,0:SYS 63562:IF {SPACE}ST>0 THEN970
FR 960 GOSUB1080:PRINT"{BLU}** LOAD COMPLETED **":GOTO220
DP 970 GOSUB1060:PRINT"{BLK}{RVS}ERROR DURING LOAD:{DOWN}[4]":ON F GOSUB980,990,1000:GOTO220
PP 980 PRINT"INCORRECT STARTING ADDRESS (";:GOSUB360:PRINT")":RETURN
GR 990 PRINT"LOAD ENDED AT ";:AD=SA+AD:GOSUB360:PRINT D$:RETURN
FD 1000 PRINT"TRUNCATED AT ENDING ADDRESS":RETURN
RX 1010 AH=INT(A/256):AL=A-(AH*256):POKE193,AL:POKE194,AH
FF 1020 AH=INT(B/256):AL=B-(AH*256):POKE174,AL:POKE175,AH:RETURN
FX 1030 IF AD<SA OR AD>EA THEN 1050
HA 1040 IF(AD>511 AND AD<40960
```

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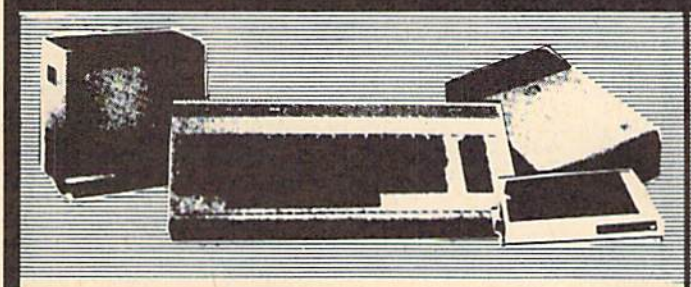

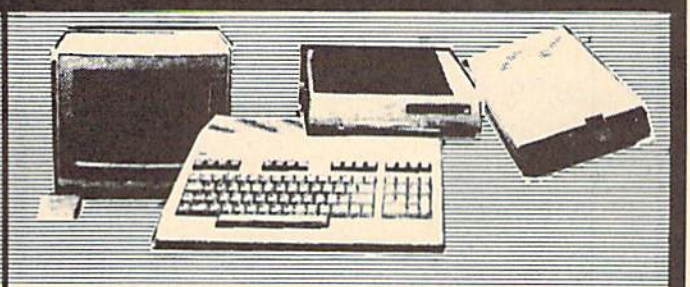

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```
        )OR(AD>49151 AND AD<53
        248)THEN GOSUB1080:F=0
        :RETURN
HC 1050 GOSUB1060:PRINT"{RVS}
        {SPACE}INVALID ADDRESS
         {DOWN}{BLK}":F=1:RETU
        RN
AR 1060 POKE SD+5,31:POKE SD+6
        ,208:POKE SD,240:POKE
        {SPACE}SD+1,4:POKE SD+
        4,33
DX 1070 FOR S=1 TO 100:NEXT:GO
        TO1090
PF 1080 POKE SD+5,8:POKE SD+6,
        240:POKE SD,0:POKE SD+
        1,90:POKE SD+4,17
AC 1090 FOR S=1 TO 100:NEXT:PO
        KE SD+4,0:POKE SD,0:PO
        KE SD+1,0:RETURN
```

Program 2: MLX For Commodore 128

```
AE 100 TRAP 960:POKE 4627,128:
       DIM NL$,A(7)
XP 110 Z2=2:Z4=254:Z5=255:Z6=2
       56:Z7=127:BS=256*PEEK(4
       627):EA=65280
FB 120 BE$=CHR$(7):RT$=CHR$(13
       ):DL$=CHR$(20):SP$=CHR$
       (32):LF$=CHR$(157)
KE 130 DEF FNHB(A)=INT(A/256):
       DEF FNLB(A)=A-FNHB(A)*2
       56:DEF FNAD(A)=PEEK(A)+
       256*PEEK(A+1)
JB 140 KEY 1,"A":KEY 3,"B":KEY
        5,"C":KEY 7,"D":VOL 15
       :IF RGR(0)=5 THEN FAST
FJ 150 PRINT"{CLR}"CHR$(142);C
       HR$(8):COLOR 0,15:COLOR
        4,15:COLOR 6,15
GQ 160 PRINT TAB(12)"{RED}
       {RVS}{2 SPACES}[9 @]
       {2 SPACES}"RT$;TAB(12)"
       {RVS}{2 SPACES}{OFF}
       {BLU} 128 MLX {RED}
       {RVS}{2 SPACES}"RT$;TAB
       (12)"{RVS}{13 SPACES}
       {BLU}"
FE 170 PRINT"{2 DOWN}
       {3 SPACES}COMPUTE!'S MA
       CHINE LANGUAGE EDITOR
       {2 DOWN}"
DK 180 PRINT"{BLK}STARTING ADD
       RESS[4]";:GOSUB 260:IF
       {SPACE}AD THEN SA=AD:EL
       SE 180
FH 190 PRINT"{BLK}{2 SPACES}EN
       DING ADDRESS[4]";:GOSUB
        260:IF AD THEN EA=AD:E
       LSE 190
MF 200 PRINT"{DOWN}{BLK}CLEAR
       {SPACE}WORKSPACE [Y/N]?
       [4]":GETKEY A$:IF A$<>"
       Y" THEN 220
QH 210 PRINT"{DOWN}{BLU}WORKIN
       G...";:BANK 0:FOR A=BS
       {SPACE}TO BS+(EA-SA)+7:
       POKE A,0:NEXT A:PRINT"D
       ONE"
DC 220 PRINT TAB(10)"{DOWN}
       {BLK}{RVS} MLX COMMAND
       {SPACE}MENU [4]{DOWN}":
       PRINT TAB(13)"{RVS}E
       {OFF}NTER DATA"RT$;TAB(
       13)"{RVS}D{OFF}ISPLAY D
       ATA"RT$;TAB(13)"{RVS}L
       {OFF}OAD FILE"
HB 230 PRINT TAB(13)"{RVS}S·
       {OFF}AVE FILE"RT$;TAB(1
       3)"{RVS}C{OFF}ATALOG DI
       SK"RT$;TAB(13)"{RVS}Q
       {OFF}UIT{DOWN}{BLK}"
AP 240 GETKEY A$:A=INSTR("EDLS
       CQ",A$):ON A GOTO 340,5
       •50,640,650,930,940:GOSU
       B 950:GOTO 240
SX 250 PRINT"STARTING AT";:GOS
       UB 260:IF(AD<>0)OR(A$=N
       L$)THEN RETURN:ELSE 250
BG 260 A$=NL$:INPUT A$:IF LEN(
       A$)=4 THEN AD=DEC(A$)
PP 270 IF AD=0 THEN BEGIN:IF A
       $<>NL$ THEN 300:ELSE RE
       TURN:BEND
MA 280 IF AD<SA OR AD>EA THEN
       {SPACE}300
PM 290 IF AD>511 AND AD<65280
       {SPACE}THEN PRINT BE$;:
       RETURN
SQ 300 GOSUB 950:PRINT"{RVS} I
       NVALID ADDRESS {DOWN}
       {BLK}":AD=0:RETURN
RD 310 CK=FNHB(AD):CK=AD-Z4*CK
       +Z5*(CK>Z7):GOTO 330
DD 320 CK=CK*Z2+Z5*(CK>Z7)+A
AH 330 CK=CK+Z5*(CK>Z5):RETURN
QD 340 PRINT BE$;"{RVS} ENTER
       {SPACE}DATA ":GOSUB 250
       :IF A$=NL$ THEN 220
JA 350 BANK 0:PRINT:F=0:OPEN 3
       ,3
BR 360 GOSUB 310:PRINT HEX$(AD
       )+":";:IF F THEN PRINT
       {SPACE}L$:PRINT"{UP}
       {5 RIGHT}";
QA 370 FOR I=0 TO 24 STEP 3:B$
       =SP$:FOR J=1 TO 2:IF F
       {SPACE}THEN B$=MID$(L$,
       I+J,1)
PS 380 PRINT"{RVS}"B$+LF$;:IF
       {SPACE}I<24 THEN PRINT"
       {OFF}";
RC 390 GETKEY A$:IF (A$>"/" AN
       D A$<":") OR(A$>"@" AND
        A$<"G") THEN 470
AC 400 IF A$="+" THEN A$="E":G
       OTO 470
QB 410 IF A$="-" THEN A$="F":G
       OTO 470
FB 420 IF A$=RT$ AND ((I=0) AN
       D (J=1) OR F) THEN PRIN
       T B$;:J=2:NEXT:I=24:GOT
       O 480
RD 430 IF A$="{HOME}" THEN PRI
       NT B$:J=2:NEXT:I=24:NEX
       T:F=0:GOTO 360
XB 440 IF (A$="{RIGHT}") AND F
        THEN PRINT B$+LF$;:GOT
       O 470
JP 450 IF A$<>LF$ AND A$<>DL$
       {SPACE}OR ((I=0) AND (J
       =1)) THEN GOSUB 950:GOT
       O 390
PS 460 A$=LF$+SP$+LF$:PRINT B$
       +LF$;:J=2-J:IF J THEN P
       RINT LF$;:I=I-3
GB 470 PRINT A$;:NEXT J:PRINT
       {SPACE}SP$;
HA 480 NEXT I:PRINT:PRINT"{UP}
       {5 RIGHT}";:L$="
       {27 SPACES}"
DP 490 FOR I=1 TO 25 STEP 3:GE
       T#3,A$,B$:IF A$=SP$ THE
       N I=25:NEXT:CLOSE 3:GOT
       O 220
BA 500 A$=A$+B$:A=DEC(A$):MID$
       (L$,I,2)=A$:IF I<25 THE
       N GOSUB 320:A(I/3)=A:GE
       T#3,A$
AR 510 NEXT I:IF A<>CK THEN GO
       SUB 950:PRINT:PRINT"
       {RVS} ERROR: REENTER LI
       NE ":F=1:GOTO 360
DX 520 PRINT BE$:B=BS+AD-SA:FO
       R I=0 TO 7:POKE B+I,A(I
       ):NEXT I
XB 530 F=0:AD=AD+8:IF AD<=EA T
       HEN 360
CA 540 CLOSE 3:PRINT"{DOWN}
       {BLU}** END OF ENTRY **
       {BLK}{2 DOWN}":GOTO 650
MC 550 PRINT BE$;"{CLR}{DOWN}
       {RVS} DISPLAY DATA ":GO
       SUB 250:IF A$=NL$ THEN
       {SPACE}220
JF 560 BANK 0:PRINT"{DOWN}
       {BLU}PRESS: {RVS}SPACE
       {OFF} TO PAUSE, {RVS}RE
       TURN{OFF} TO BREAK[4]
       {DOWN}"
XA 570 PRINT HEX$(AD)+":";:GOS
       UB 310:B=BS+AD-SA
DJ 580 FOR I=B TO B+7:A=PEEK(I
       ):PRINT RIGHT$(HEX$(A),
       2);SP$;:GOSUB 320:NEXT
       {SPACE}I
XB 590 PRINT"{RVS}";RIGHT$(HEX
       $(CK),2)
GR 600 F=1:AD=AD+8:IF AD>EA TH
       EN PRINT"{BLU}** END OF
        DATA **":GOTO 220
EB 610 GET A$:IF A$=RT$ THEN P
       RINT BE$:GOTO 220
QK 620 IF A$=SP$ THEN F=F+1:PR
       INT BE$;
XS 630 ON F GOTO 570,610,570
RF 640 PRINT BE$"{DOWN}{RVS} L
       OAD DATA ":OP=1:GOTO 66
       0
BP 650 PRINT BE$"{DOWN}{RVS} S
       AVE FILE ":OP=0
DM 660 F=0:F$=NL$:INPUT"FILENA
       ME[4]";F$:IF F$=NL$ THE
       N 220
RF 670 PRINT"{DOWN}{BLK}{RVS}T
       {OFF}APE OR {RVS}D{OFF}
       ISK: [4]";
SQ 680 GETKEY A$:IF A$="T" THE
       N 850:ELSE IF A$<>"D" T
       HEN 680
SP 690 PRINT"DISK{DOWN}":IF OP
        THEN 760
EG 700 DOPEN#1,(F$+",P"),W:IF
       {SPACE}DS THEN A$=DS$:G
       OTO 740
JH 710 BANK 0:POKE BS-2,FNLB(S
       A):POKE BS-1,FNHB(SA):P
       RINT"SAVING ";F$:PRINT
MC 720 FOR A=BS-2 TO BS+EA-SA:
       PRINT#1,CHR$(PEEK(A));:
       IF ST THEN A$="DISK WRI
       TE ERROR":GOTO 750
GC 730 NEXT A:CLOSE 1:PRINT"
       {BLU}** SAVE COMPLETED
       {SPACE}WITHOUT ERRORS *
       *":GOTO 220
RA 740 IF DS=63 THEN BEGIN:CLO
       SE 1:INPUT"{BLK}REPLACE
        EXISTING FILE [Y/N][4]
       ";A$:IF A$="Y" THEN SCR
       ATCH(F$):PRINT:GOTO 700
       :ELSE PRINT"{BLK}":GOTO
        660:BEND
GA 750 CLOSE 1:GOSUB 950:PRINT
       "{BLK}{RVS} ERROR DURIN
       G SAVE: [4]":PRINT A$:G
       OTO 220
FD 760 DOPEN#1,(F$+",P"):IF DS
        THEN A$=DS$:F=4:CLOSE
       {SPACE}1:GOTO 790
```

```
PX 770 GET#1,A$,B$:CLOSE 1:AD=
       ASC(A$)+256*ASC(B$):IF
       {SPACE}AD<>SA THEN F=1:
       GOTO 790
KB 780 PRINT"LOADING ";F$:PRIN
       T:BLOAD(F$),B0,P(BS):AD
       =SA+FNAD(174)-BS-1:F=-2
       *(AD<EA)-3*(AD>EA)
RQ 790 IF F THEN 800:ELSE PRIN
       T"{BLU}** LOAD COMPLETE
       D WITHOUT ERRORS **":GO
       TO 220
ER 800 GOSUB 950:PRINT"{BLK}
       {RVS} ERROR DURING LOAD
       : [4]":ON F GOSUB 810,8
       20,830,840:GOTO220
QJ 810 PRINT"INCORRECT STARTIN
       G ADDRESS (";HEX$(AD);"
       )":RETURN
DP 820 PRINT"LOAD ENDED AT ";H
       EX$(AD):RETURN
EB 830 PRINT"TRUNCATED AT ENDI
       NG ADDRESS ("HEX$(EA)")
       ":RETURN
FP 840 PRINT"DISK ERROR ";A$:R
       ETURN
KS 850 PRINT"TAPE":AD=POINTER(
       F$):BANK 1:A=PEEK(AD):A
       L=PEEK(AD+1):AH=PEEK(AD
       +2)
XX 860 BANK 15:SYS DEC("FF68")
       ,0,1:SYS DEC("FFBA"),1,
       1,0:SYS DEC("FFBD"),A,A
       L,AH:SYS DEC("FF90"),12
       8:IF OP THEN 890
FG 870 PRINT:A=SA:B=EA+1:GOSUB
        920:SYS DEC("E919"),3:
       PRINT"SAVING ";F$
AB 880 A=BS:B=BS+(EA-SA)+1:GOS
       UB 920:SYS DEC("EA18"):
       PRINT"{DOWN}{BLU}** TAP
       E SAVE COMPLETED **":GO
       TO 220
CP 890 SYS DEC("E99A"):PRINT:I
       F PEEK(2816)=5 THEN GOS
       UB 950:PRINT"{DOWN}
       {BLK}{RVS} FILE NOT FOU
       ND ":GOTO 220
GQ 900 PRINT"LOADING ...{DOWN}
       ":AD=FNAD(2817):IF AD<>
       SA THEN F=1:GOTO 800:EL
       SE AD=FNAD(2819)-1:F=-2
       *(AD<EA)-3*(AD>EA)
JD 910 A=BS:B=BS+(EA-SA)+1:GOS
       UB 920:SYS DEC("E9FB"):
       IF ST>0 THEN 800:ELSE 7
       90
XB 920 POKE193,FNLB(A):POKE194
       ,FNHB(A):POKE 174,FNLB(
       B):POKE 175,FNHB(B):RET
       URN
CP 930 CATALOG:PRINT"{DOWN}
       {BLU}** PRESS ANY KEY F
       OR MENU **":GETKEY A$:G
       OTO 220
MM 940 PRINT BE$"{RVS} QUIT
       [4]";RT$;"ARE YOU SURE
       {SPACE}[Y/N]?":GETKEY A
       $:IF A$<>"Y" THEN 220:E
       LSE PRINT"{CLR}":BANK 1
       5:END
JE 950 SOUND 1,500,10:RETURN
AF 960 IF ER=14 AND EL=260 THE
       N RESUME 300
MK 970 IF ER=14 AND EL=500 THE
       N RESUME NEXT
KJ 980 IF ER=4 AND EL=780 THEN
        F=4:A$=DS$:RESUME 800
DQ 990 IF ER=30 THEN RESUME:EL
       SE PRINT ERR$(ER);" ERR
       OR IN LINE";EL
```


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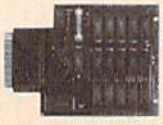

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Reader Service Number/Advertiser	Page
102 Abacus	38
103 Accolade	39
104 Acorn of Indiana	116
105 ActionSoft Corp.	22–23
106 Activision, Inc.	11
107 Aprotek	113
108 The Avalon Hill Game Company	19
109 The Avalon Hill Game Company	35
110 Berkeley Softworks	8–9
111 Blackship Computer Supply	105
113 Camera World	127
114 Cardinal Software	105
115 Central Point Software	18
116 Cheatsheet Products, Inc.	116
117 C-More Products	112
118 Compumed	105
119 CompuServe	31
120 ComputAbility	117
121 Computer Direct	53–55
122 Computer Mail Order	115
123 Computer Mart	50
123 Computer Mart	110–111
125 Computer Repeats, Inc.	87

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126 Computer World	129
Crown Custom Covers	130
127 Electronic Arts	IFC
128 Emerald Components International	59
129 Emerald Components International	IBC
130 EPYX	2
131 EPYX	43
132 Eychaner Software Co.	130
133 Federal Hill Software	114
134 Free Spirit Software	46
135 H & P Computers	123
136 Inkwell Systems	79
Intelligent I/O	114
J&K Enterprises	81
137 Lance Haffner Games	112
138 Lyco Computer	64–67
139 Maxtron	87
140 M.C.S.	106–107
141 Mibro Company	125
142 MicroProse Simulation Software	47
143 MicroProse Simulation Software	1
Mindscape, Inc.	5
144 Modern Photography	7
145 Montgomery Grant	119
146 NAPI	112
112 National Computer Marketing	63
NRI Schools	85
147 Origin Systems, Inc.	BC
148 P.A.V.Y. Software	86
149 Precision Data Products	131
150 Pro-Tech-Tronics	57
151 Q-Link	37
152 Renco Computer Printer Supplies	116
153 S & S Wholesalers	60–61
Schnedler Systems, Inc.	130
154 Signal Computer Consultants	110
155 Soft-Byte	105
156 Software Discounters of America	108–109
157 Spinnaker	12–13
158 Strategic Simulations, Inc.	33
159 subLOGIC Corporation	29
160 Superior Micro Systems, Inc.	130
161 TCO Software	86
Tektonics Plus, Inc.	132
162 Tenex Computer Express	121
163 Those Designers	80
164 Timeworks, Inc.	14–15
165 Triad Computers	58
166 Tussey Computer Products	25–27
167 Unison World	45
168 Unitech	80
170 Utilities Unlimited, Inc.	51
171 Virtusonics Corporation	49
172 Xetec, Inc.	114

Classified Ads	131
COMPUTE! Books' Commodore 64 & 128 Programming Books	70
COMPUTE!'s Sweepstakes	17

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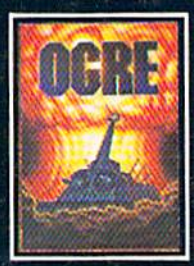

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